



CHEETAL

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The Wild Life Preservation Society of India

Vol. 15

No. 1

I.U.C.N. SPECIAL ISSUE

Photo by : Nihar Swain.



Wild Life Preservation Society of India

1. The aims and objects of the Society are as follows:—

- (a) To promote interest in and impart knowledge regarding the preservation and conservation of all forms of wild life, particularly among the youth of the country.
- (b) To co-operate with the Govts. of India and States and with other Societies and Institutions having similar aims and objects in working for the interests of wild life.
- (c) To assist in enforcing and actively supporting the Forest Acts, Wild Birds and Animals Protection Acts and Rules etc. of States and the Indian Arms Act and Rules in so far as they pertain to wild life and to bring to the notice of the authorities any infringement of the same and to assist in the detection and prosecution of offenders in respect of such laws.
- (d) To advise and help the Govt. and wild life administrators in the formation, maintenance and protection of Sanctuaries and National Parks, the preservation of wild life in general and rare species of India in particular and in the introduction of exotic species into the country, the rehabilitation of rare species etc. and in the revision on rational lines of the shooting and fishing rules, so as to conserve and increase wild life stocks.
- (e) To raise funds for the carrying out of the above aims and objects and to found and maintain museums, reading rooms and libraries of natural history in order to disseminate knowledge regarding wild life.
- (f) To promote sportsmanship in shikar and to recognise well regulated shooting and fishing, as a means of preserving wild life and fish so that through wise use the surplus may provide a recreational asset to the nation.
- (g) To carry out publicity and propaganda for the preservation of wild life in India by means of monographs, journals, films, film strips and other feasible methods.
- (h) To assist members of the Society in obtaining shooting and fishing facilities and facilities for viewing and photographing wild life in India.
- (i) To conduct research into the problem of Wild Life management in India, and in pursuance of this, to initiate, encourage and, where possible assist in projects for the study of threatened species and related subjects and to provide reference and research facilities for such work.
- (j) To carry on such other activities which will serve the above subjects.

What membership of Wild Life Preservation Society of India will entitle you to ?

1. You will become an active member of the growing group of Wild Life enthusiasts, who enjoy working for and spreading the knowledge of how to conserve India's heritage of Wild Life for posterity.
2. You will be entitled to the full use of the Library of the Wild Life Preservation Society and of its reading room.
3. You will receive a membership certificate.
4. You will receive personal Identification and Membership card.
5. You will be entitled to buy all publications of the Society at a concessional rate.
6. You will be entitled to buy at concessional rates the Society's Greeting Cards, Calendars, Tie, Lapel badge and the Balance of Nature Game (specially Published in colour for its educative and recreational value).
7. You will be supplied "Cheetal", the quarterly journal of the Society free.

For membership particulars write to Honorary Secretary, Wild Life Preservation Society of India, 7 Astley Hall, Dehra Dun.

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Members and Subscribers are requested to note that all yearly subscriptions fall due on 1st of April each year. They are requested to pay in time so that Cheetal may be sent to them regularly.

Change of address should be intimated at the earliest to prevent Cheetal being lost in transit.

Honorary Secretary.



पर्यटन तथा नागर विमानन मंत्री
MINISTER OF TOURISM & CIVIL AVIATION

I am happy to know that a special issue of CHEETAL is being brought out by the Wild Life Preservation Society of India on the occasion of the forthcoming IUCN Conference at Banff. Under the personal inspiration of Prime Minister Indira Gandhi we have been active over the last two or three years in an attempt to preserve from extinction many rare and beautiful species of wild life, specially the magnificent Indian tiger. India has a unique spectrum of wild life including ten large predators, five members of the bear family and ten different types of deer. Our efforts are now directed on the one hand towards preservation, and on the other towards presentation of these animals for tourist viewing.

The Wild Life Preservation Society of India is a leading body which has rendered valuable service to the cause of wild life. On the occasion of this special issue I send my good wishes to the Society and, through the pages of CHEETAL, to lovers of wild life throughout the world.

Karan Singh
Chairman
Indian Board for Wild Life

New Delhi,
July 26, 1972



भारत सरकार
कृषि मन्त्रालय
(कृषि विभाग)

GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE
(DEPARTMENT OF AGRICULTURE)

NEW DELHI

July 28, 1972.

MESSAGE

I am glad to learn that the Wild Life Preservation Society of India is bringing out a special issue of their quarterly journal "Cheetal" to commemorate the I.U.C.N. Conference at Banff, Canada, during September, 1972. The last I.U.C.N. Conference was held in November-December, 1969, at New Delhi. The Society celebrated that occasion also by bringing out a special number which was very much appreciated by the delegates.

The Wild Life Preservation Society of India was founded at Dehra Dun, in the State of Uttar Pradesh in 1958. It started with a small nucleus which has been growing steadily and the Society has excellent work to its credit in carrying the message of wild life preservation to the nook and corner of the country. "Cheetal" magazine published by the Society has been quite popular with Naturalists and Foresters. I am quite sure that in times to come this publication will get a much wider circulation in India and abroad and will succeed in its objective of creating necessary awakening towards wild life preservation.

Wild Life in its various forms is our most fascinating and colourful heritage. Very few countries in the world are as fortunate as India in this respect. We have some 500 species of mammals and 2000 species of birds besides a large variety of reptiles, amphibians, fishes, crustaceans and insects. In earlier times we looked after our wild life well, but during the last quarter of the century the increasing population, industrial development and the number of sportsmen has been making considerable inroads on the wild life habitat and consequently its population. The Government is promulgating various acts and rules for the protection of wild life and its habitat but this can be effectively possible only with the active co-operation of public. In this mission the Wild Life Preservation Society of India and its magazine the "Cheetal" have been doing laudable work and I wish all success to the Society in its efforts.

T.N. Srivastava
Inspector General of Forests
& Ex-officio Addl. Secretary

Letter to the Wild Life Preservation Society of India, DEHRA DUN.



UNION INTERNATIONALE POUR LA CONSERVATION DE LA NATURE ET DE SES RESSOURCES
INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES
1110 MORGES, SUISSE [SWITZERLAND] PHONE [021] 714401 TELEGRAMMES: UNICORN MORGES

Dr. R.N. Misra
Honorary Secretary
Wild Life Preservation Society of India
7, Astley Hall
DEHRA DUN, U.P./India
26 July 1972

Dear Dr. Misra,

We were delighted to learn that *Cheetal* will devote an issue to mark the XIth General Assembly of IUCN, which will be held in Banff, Canada, in September.

Once again, as it has so often in the past, *Cheetal* is performing an outstanding service to the world of conservation.

The IUCN is, of course, highly pleased by the growing attention being paid to vital conservation issues in India—by official departments, by organizations, and by individuals. We feel that much credit for this is certainly due to the Wild Life Preservation Society of India.

At the same time, not one of us can afford to let up in our endeavours. It has been said that in these days one must run to simply stay in the same place, such is the acceleration of our growing environmental problems around the world. Quite obviously, you are not letting up but rather quickening the pace in all your excellent work.

We all remember with much pleasure the warm welcome we received in New Delhi—and wherever our people went—when India was host to the last General Assembly in 1969.

We look forward to greeting your representatives in Banff, and a few days later, at the Second World Conference on National Parks in the U.S.A.

On behalf of our President, Mr. Harold J. Coolidge, and all of the staff here in Morges, may we thank you for your thoughtful kindness in preparing this special issue.

With all good wishes,

Sincerely yours,
Frank G. Nicholls
Deputy Director General

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VOL. XV

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No. 1

Editorial

Status of Wild Life in India

India is unique in having a physiography and location favouring the meeting of animal forms from the Oriental, Palearctic and Ethiopian Zoogeographical regions. We had, for example all 4 genera of cats viz. *Acinonyx*, *Panthera*, *Felis* and *Neofelis*. It is unfortunate that one of them is now believed extinct (*Acinonyx*) and that too within the last 3 decades. But there is still a large variety of animal, bird and plant life and while some have been lost due to ignorance and neglect, there is much to be conserved, if urgent measures are taken to do so.

The history of wild life conservation in India is comparatively short because there was such an abundance of wild life in India that production generally compensated for the destruction. It was the advent of modern weapons and the improvement of communications which increased the rate of destruction much in excess of the production. Added to this, within that last two to three decades, the demands of an increasing population for land, have alarmingly reduced the wild life habitat. This is perhaps true in most developing countries but more so in India with its severe population problems. In this country the precepts of 'Ahimsa' helped save wild life in many areas, but like all such precepts, modern society has thrown it over-board except in a few areas like Rajasthan, Gujarat etc. where it has enabled some species to co-exist with man, despite the apparent competition.

Early efforts to protect some of the large mammals which were unique to the country, met with some success. The Great Indian One-horned Rhino (*Rhinoceros unicornis*) the Indian elephant (*Elephas maximus*), the Indian lion (*Panthera leo persica*) the Indian wild ass (*Equus onager indicus*) have been saved from extinction and the first two have now increased to numbers where they can be cropped. But the rate at which many other species have been destroyed has caused great concern to all biologists and wild life enthusiasts in this country and abroad. It was this concern which led us to seek the assistance of the International Union for the Conservation of Nature and Natural Resources (I.U.C.N.) with its many experts, in helping the country to solve some of its problems in the conservation of wild life.

It is now nearly three years—November-December 1969—since India was host to the 10th General Assembly and 11th Technical Meeting of the I.U.C.N. which was held in New Delhi. These meetings served many purposes, for not only was it possible to discuss various problems concerning wild life but it served to publicize wild life conservation and highlight its economic, social and recreational aspects in a developing country where tourism is an important source of foreign exchange. A number of pre and post conference tours were conducted and a large body of persons concerned with wild life were able to meet and exchange views. Gradually, over the past three years the wild life conservation movement has spread in India and there is now a larger body of people interested in this subject. One small example is, that this journal—CHEETAL—which was published as a half-yearly, is now a quarterly; another is the increased membership of the parent body—the Wildlife Preservation Society of India and its branches.

There have also been a number of other positive steps to a better understanding of wild life conservation. A 6 months course on Wild Life Management was introduced at the Forest Research Institute and Colleges, Dehra Dun in 1970, and 30 persons have so far been trained as wildlife managers. They are now employed in responsible positions in the wild life organizations of the States Forest Departments. The Ecological Research Unit set up in the Gir forests of Gujarat State, with international assistance, has done valuable work in the co-ordinated study of the ecological conditions in these forests, for a better appreciation of the survival of the lion. An All-India tiger census, based on the methodology evolved by Indian expertise, (details in this issue) is now being conducted to study the present status of this valuable and unique animal, so that more positive and logical efforts to conserve it, may be taken. Its total protection was promulgated a few years ago and there is a ban on the export of its skin. The Government of India are also in the process of introducing legislation in Parliament to enforce wild life management in most of the States of the Union, with the latter's consent. The National Council on Science and Technological is also formulating a number of schemes on wild life conservation. All these are no doubt important steps to a better appreciation of the importance of wild life in human ecology and economy but much more remains to be done. One major lacuna is that the younger generation has yet to be educated in wildlife conservation. Text books on the subject do not exist and lessons on wild life are uninteresting and frequently factually incorrect. There are not enough clubs and societies which aim to inculcate a love for wildlife in the youth. The older generation were fortunate in many cases in witnessing a part of the wild life wealth we had inherited, the younger generation would be justified in holding us guilty in not passing on this wealth to them.

The CHEETAL and the wild life Preservation Society of India wish the deliberations of the I.U.C.N. at Banff in Canada, every success and hope that the Government of India would take this opportunity to send a strong delegation to the conference to represent this country.

India's Threatened Hardground Barasingha

By

M. KRISHNAN

Oddly enough, the reason why the possible extinction of the splendid hardground barasingha of Madhya Pradesh is not as widely appreciated as it should be, is that it has no universally-known, exclusive name. The word 'barasingha' merely means '12-tined', and is locally applied both to the Kashmir Stag or Hangul, and to both subspecies of the swamp deer.

The adult stag of all these three kinds of deer usually carries 12 tines, occasionally more. Of these the Hangul (*Cervus elaphus hanglu*—a subspecies of the European red deer, more or less confined to Kashmir) need not be termed 'barasingha', having two other specific names in English. The subspecies of the swamp deer with the wider distribution (in Uttar Pradesh and Assam in India, and in Nepal) is *Cervus duvauceli duvauceli*, the swamp-loving subspecies: incidentally, where swamps have been reclaimed, as in parts of Uttar Pradesh, it seems to be doing well enough in the neighbourhood of such marshy areas as it can find.

The hardground subspecies is *Cervus duvauceli branderi*, now virtually limited to the Kanha area of Madhya Pradesh. It is the feature of the Kanha National Park, which was set up with the object of saving this magnificent and peculiarly Indian deer, when it declined alarmingly from the thousands in which Forsyth reported it in the area a hundred years ago, to the hundreds in which Dunbar Brander (after whom it is named) had known it in the same area fifty years ago, to under a hundred now.

The distinction between the two subspecies of the barasingha is not too clearly apparent, and is said to lie in the more splayed-out hooves and heavier skull of the swampground variety: the antlers attain their finest development in the hardground subspecies of Madhya Pradesh. Both have similar feeding habits and live mainly on coarse grasses, varied with browsed twigs, tree foliage and fruits.

The main difference between them seems to be that one favours swampy ground and spends hours wading through shallow water, while the other likes hard ground and is much handsomer. I have been asked why I favour the name 'hardground barasingha' and 'swamp deer' to distinguish between the two subspecies of *Cervus duvauceli*, when the term 'swamp deer' is already available: well, I do not think much of 'hardground swamp deer' and 'marshland swamp deer' as specific terms. To distinguish between varieties of the caribou, mainly told apart by their habitat preferences, specific names based entirely on the different environments they favour have already been long established, and I feel that a similar distinction may be made between the two varieties of *Cervus duvauceli*.

Schaller, who worked intensively in Kanha for 2 years (*The Deer and the Tiger*) and evaluates the total population at nearer 50 than 100, points out the degeneration evidenced by the scarcity of young, and assigns poaching, and possibly some infection such as brucellosis, as the causes of decline, rather than natural predation.

My figures for the Kanha population (based on three summer visits in 1968, '69 and '70), are a little higher, but still within 100. In March 1970 I saw 10 fawns, about 6 months of age in Kanha, the first encouraging sign noticed in years.

Besides tightening up protection, the official effort to save the deer consists of the erection of a large stockade for holding a few specimens, so that the probable causes of their decline and remedial measures may be studied intensively.

In any animal that is highly gregarious by nature (as both subspecies of the barasingha are) the decline of the population to below the biological minimum necessary to assure survival is itself a most potent threat. I was struck by the lassitude of the deer at Kanha, as compared to the wild alertness of the swampground variety in Uttar Pradesh and Assam. The morphological differences between the two subspecies being slight, and probably due to differences in environment, I suggested that the Kanha population should be revived by infusing fresh blood into it, by introducing a few of the swampground deer from Uttar Pradesh into Kanha. The history of livestock breeding, particularly the revival of the Irish Wolfhound when it exhibited marked bodily degeneration, will testify to the value of an outcross when the position seems desperate. However my scheme, which involves considerable effort and co-ordination, and sustained vigilance, has not been adopted.

There can be no two opinions on the imperative need to try and save this exclusively Indian and magnificently antlered deer. The object of this note is to attract the attention of conservationists all over the world to the precarious position of the hardground barasingha today—perhaps this will be of some practical value in finding an effective solution to the problem.



India's threatened hardground barasingha.

Photograph by M. Krishnan.



For India's threatened hardground barasingha "thou inheritor of unfulfilled renown"—
fawn and going mother. *Photograph by Shri M. Krishnan.*



Fresh rhino kill by a poacher.

Photograph by Shri R. Bannerjee.

The Great Indian One-Horned Rhinoceros (*Rhinoceros unicornis*) with Special Reference to its Main Sanctuary, Kaziranga, in Assam

By

RICHARD WALLER

There are five species of rhinoceros still in existence. Two of these are found in Africa and three in Asia; of the three in Asia only the Indian One-Horned Rhinoceros holds out any real hope of being preserved for future generations. The other two are the Javan One-Horned and the Sumatran Two-Horned, both of which are down to 20—50 individuals at the most.

The present status of the Great Indian One-Horned Rhinoceros is also that of an endangered species, and is entered as such in the 'Red Book' of the I.U.C.N. Its numbers are estimated at about 805 in all, and these concentrated in a limited area along the base of the Himalayan foothills from the Nepal terai in the west, through the north of West Bengal into Assam in the east.

The situation in Nepal is depressing as regards present numbers, but very hopeful in recent conservation legislation. In 1964 the estimate was 185 (E.P. Gee—Wildlife of India); in 1966 it was 100 or less (J. Spillett—Bombay Natural History Society Journal Vol. 63.3); but it is doubtful if more than 80 now remain—all in the Royal Chitawan National Park. The hopeful aspect is that Chitawan has recently been declared a National Park.

50,000 to 80,000 villagers live on the borders of the Park and upto recently, grazed many thousands of cattle within the Park whose rhino habitat has now been virtually destroyed, with the exception of the 150 acres around 'Tiger Tops'. This area has been leased to the company for 15 years by the Govt. of Nepal and the company protects it carefully so that their many foreign clients may see rhino. In 1970, and I quote from my own notes of two years ago, "The numbers of rhino are steadily diminishing and the last vestiges of habitat are being inexorably destroyed by the thousands of cattle and buffalo which over-run Chitawan."

However, events have been moving most hopefully there during the last year. The Govt., with the full backing of the King, allocated funds for the demarcation, re-habilitation and protection of Chitawan. The demarcation has been done, and it has been declared the Royal Chitawan National Park. The efficiency of protection against poaching increases monthly. Villages will be moved, where necessary, and alternative grazing will be found

for the cattle and domestic buffalo. These are excellent steps, thanks to the interest of the former King of Nepal and his son, the present King, together with the keenness and persistence of John Blower, the U.N. Wildlife Adviser: and if continued with zeal, should ensure the existence of the rhino and the steady build-up of its numbers as its favourite habitat is gradually restored in the Royal Chitawan National Park.

In India, where this species of rhino is now confined to Assam and the north of West Bengal, its history over the last 65 years, in spite of various set-backs, is a triumph of wildlife conservation and efficient protection, especially in the famous Kaziranga Sanctuary in Assam. Early moves were made in the days of the British in India when, in 1906, the wife of the Chief Commissioner of Assam was most disappointed at failing to see rhino in this area after a day's search on an elephant. Reading the records of the earliest Kaziranga Reserve, her failure is not surprising as the numbers of rhino were estimated at about 40 and some put them as low as 20. The British Tea Planters had slaughtered nearly the lot. Luckily for the world, the Chief Commissioner's wife was a forceful lady and brought such pressure to bear on her husband that he ordered the formation of the Kaziranga Reserve in 1907 and, with a fine disregard for the tea planters of his day, made the first step in saving this species of rhino from extinction.

Kaziranga went through bad times after World War II when poaching for rhino horn was at its height and the very people who were supposed to be protecting the rhino were in league with the poachers and shared their profits. In the early fifties there was a clean-up, followed by the excellent partnership of P.D. Stracy at the top as Chief Conservator, E.P. Gee at hand to advise and R.C. Das running the sanctuary. This combination firmly established Kaziranga as the best sanctuary for rhino, by controlling poaching and greatly increasing the numbers of all animals. India was lucky to have such men available at that time to ensure the future of the rhino and Kaziranga. It still has them, and the present staff, overall, is the keenest and most dedicated I have come across in India.

Further success has continued in the rehabilitation of the rhino since E.P. Gee (Wildlife of India 1964) estimated 440 for India (Assam 375 and West Bengal 65). The figure for India is now about 725, of which Kaziranga has 600+, Manas 40 with about 20 in other small reserves; while West Bengal has 65, mainly in Jaldapara and a few in Gorumara.

In 1966, Spillett (Spillett B.N.H.S. 1966) estimated 580 for India. There has been a decrease in certain areas due to heavy poaching for rhino horn in the small poorly protected reserves in Assam as well as outside these reserves, for which he estimated 70 and 40 respectively; of these rhino very few remain. On the other hand, numbers in the well-protected sanctuaries have risen since 1966:—Jaldapara and Gorumara from 50 to 65, Manas 15 to 40 while Kaziranga recorded a marked increase from 400 in 1966 to over 600 in March 1972. This figure is not yet official and is being re-checked; it may well be 650. From these figures we can see clearly the effect of good administration and protection, and vice versa. There



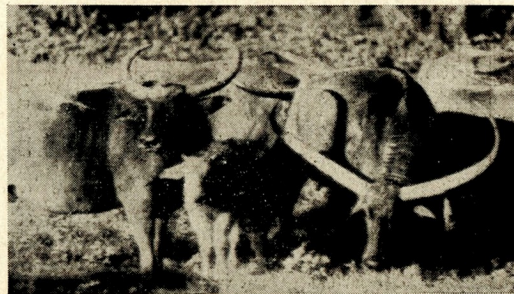
Rhino with passenger !



Charging Rhino—Kaziranga.



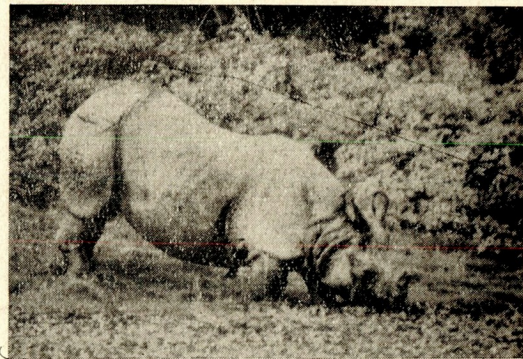
A herd of swamp deer—Kaziranga.



Wild buffalo—Kaziranga



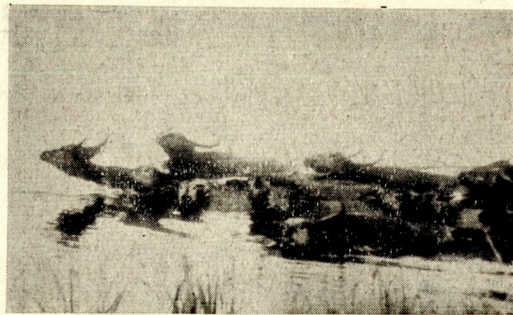
Tiger—close-up.



Rhino in a wallow.



An ambling tiger.



Buffaloes in a wallow—Kaziranga.

is absolutely no alternative when it comes to saving a species but the right men determined to do a good job.

The estimated status in 1972 of the numbers of Great Indian One-Horned Rhinoceros can be given:—

Assam: (India)	Kaziranga Sanctuary	600+	} 660
	Manas Sanctuary	40	
	Small sanctuaries with little or no protection	20	
West Bengal: (India)	Jaldapara	60	} 65
	Gorumara	5	
Nepal:	Chitawan	80	
		805	

Kaziranga Sanctuary in Assam is undoubtedly the best place for viewing this species of rhino, with Jaldapara in West Bengal a good second. In view of the importance of Kaziranga both from the rhino point of view and from good tourist facilities for viewing it and other animals, I think it is worth while giving a description of the sanctuary and some of my experiences there, during 1970 and 1972.

Its area is 430 sq. kms. (166 sq. miles), less about 38 sq. kms. (15 sq. miles) lost by erosion along the Brahmaputra river since 1950. It will shortly be increased by 30 sq. kms. (12 sq. miles) of the Mikir Hills to allow for protection of migrating elephant and hog deer.

The habitat is essentially riverine on the Brahmaputra flood plain. It consists of four main types:—

- (1) Open grassland or maidan with 70 to 200 cm. (2 to 6 ft.) high grass (*Erianthus* and *Saccharum* species), already partly flooded in the second half of May by early pre-monsoon rain. This is the main area for swamp and hog deer.
- (2) Tall grass and reeds (*Arundo donax* and *Phragmites* sp.) often over 4 m. (13 ft.) high and boardering:—
- (3) the many small lakes or 'bils' with interconnecting streams,
- (4) Islands, usually just above flood level, covered with fairly open tropical semi-evergreen forest (*Bombax ceiba*, *Albizia* and *Lagerstroemia* species are dominant). Annual rainfall is 2,000 mm. (80");

Just as the first area, when dry or not too deeply flooded, is the favourite habitat of swamp and hog deer, with sambar largely confined to the forested islands, so the second

and third areas are the ones in which rhino and wild buffalo are certain to be seen. Part of the grassland area is burnt each year in January and February and the quickly growing new shoots attract the herbivores. The annual flooding is destructive in its erosion of the northern boundary, but beneficial in so far as it appears to be the only check on the insidious water hyacinth (*Eichhornia crassipes*) which covers parts of the lakes and water courses. Attempts are being made to rake this off the 'bils' by elephant or other power. The flood waters also irrigate the maidans and re-stock the lakes with fish for the numerous otters and water birds.

The following species and numbers were given me, based on a census done on the block system in March 1972:—

Rhino	600+ (though 650 were actually counted)
Wild Buffalo	550
Elephant	450
Swamp Deer	520
Sambar	200+
Hog Deer	4,500+
Tiger	7 sighted (probably about 20)

Of other species, pig and otter were common, both the black bears and barking deer are occasionally seen, while leopard and gaur are rare.

This well known sanctuary is rightly famous for its rhino and wild buffalo (*Bubalus bubalis*). The populations of both species appear to be in a healthy state with a good female: young ratio (178 cow rhino had calves in the recent census). Considering the area of Kaziranga and the difficulty of any extensive enlargement southwards into the Mikir Hills, it is quite possible that the present figures for these two species represent the maximum that can be carried, and they should not be allowed to increase further, though range conditions do appear to be good. A careful study is needed, as social conditions could be aggravated with consequent fighting for territorial space.

There is, of course, the ever present danger of poaching for the rhino's horn, and killings do still occur as the poachers are professionals. They come in by night, lie up till dawn when they shoot a rhino or sometimes kill in a previously prepared pit, lie up again till night fall and then escape with their spoil. More regular patrols, in small groups and armed since the poachers will fight, and equipped with two-way radio sets could almost eliminate rhino poaching. The present Divisional Forest Officer, who has a real love and knowledge of the sanctuary, takes the poaching hazard very seriously and is doing an excellent job, well backed by his Range Officer, Forest Guards and Game Watchers as well as fifty special armed Guards. There are 23 permanent guard camps in and on the edge of the sanctuary, with at least 3 men in each. Between all camps, lines are re-cut after the monsoon, in October, to facilitate movement of anti-poaching patrols as well as observation

of animals. In certain cases where the terrain is very difficult, one or two elephants (normally for tourist use) will be sent out for a period to patrol a particular area. There is a patrolling staff of about 80 (mostly Forest Guards and Game Watchers) assisted by 50 armed Home Guards; the latter are expressly for use against the gangs of professional armed poachers. Rewards are paid to guards involved in fights with poachers: Rs. 200 to each guard directly involved in countering a poaching attempt, and between Rs. 50 and Rs. 80 to staff not directly involved but who helped in the operation.

I continue on a more personal note to give an idea of the richness of Kaziranga. We spent several evenings at a certain bridge over a water course in the Kaziranga block about 4 kms. into the sanctuary. From here, just before and after sunset, the wealth of this sanctuary's wildlife could be fully realised. There were never less than five rhino, either partly submerged in water or grazing on the banks, within 60 metres of us, and one evening there were eight. To one side and beyond the tall reeds, where the swamp partridges (*Francolinus gularis*) were calling, stretched the open grasslands where swamp deer stags were grazing in the late sunlight and numerous hog deer were just discernible in the swaying grass. The whistle of an otter then drew our attention to the water below and there was a pair swimming past, their heads above the water. One of them, nearing the bank, stood on his hind legs and looked at us before they both dived off at speed, leaving lines of bubbles on the surface. On the silk-cotton tree (*Bombax ceiba*) above us, were two pelicans and five open-bill storks and, in the reed bed below, two purple herons, a large egret and a black bittern (*Dupetor flavicollis*), while a few minutes later a chestnut bittern (*Ixobrychus cinnamomeus*) flew in, his rich cinnamon colour as if lit from inside in the last rays of the sunset. Before the sun finally left us that evening the head of a swimming body was seen moving across a stretch of open water only about 50 m. away; we thought at first it was a large otter, but as we looked more carefully the creature swam into sunlit water and we could see the separate scales on the head of the fine monitor lizard.

Another evening in a nearby 'bil' I watched three rhino apparently cropping the underwater grass, recently flooded. All three were below the surface, showing only the horn and two ears clearly. Every minute or so, one or other of the rhino would submerge completely, disappearing from view for about 10 seconds and then re-surface with bits of mud and grass dropping from its lips. They must have been just in their depth most of the time, at nearly 2 m. of water, but now and again one of them would clearly swim in order to take up a fresh position on the bottom of the 'bil'.

Once I watched a bull rhino at close quarters alternately cropping grass and then water hyacinth. If only more of them would take to eating this insidious weed, it might not be such a menace!

It is unwise to walk much in highly populated rhino country unless one has a following domestic elephant. Rhino are not aggressive unless with calf, only curious to explore a certain smell or noise. Such a human smell must have agitated the two that came snorting and crashing towards me through the tall grass one afternoon. Luckily I heard them sufficiently far off to be able to reach a convenient tree which I went up like a monkey. They then came up to the tree and one even appeared to look upwards to my precarious position on a low branch; afterwards, wheeling off, they made a circle through the reeds returning with snorts to the same tree. This was repeated yet again and made me so nervous I couldn't hold my camera still! Presumably they got my wind again each time they withdrew and this stimulated another sally. So, on the third circle when they reached the furthest point, I came down and ran the fastest half mile of my life to a waiting jeep.

There is much evidence of animals feeling a sense of security in a sanctuary. Recently an old bull rhino, sensing his end, came deliberately near a guard post on the edge of the park. The guards even fed and watered him for three days where he lay before he died.

Kaziranga has a great future and, by reason of its habitat and species, can combine most happily, wildlife orientation and development with tourist attractions. Animals can be seen easily and comfortably in their natural surroundings and although the sanctuary itself is flat, the backdrop of the snow-covered peaks of the Himalayas in the cold season, gives it a fabulous settings.

I hope to have given some idea of this magnificent sanctuary whose staff is doing such a fine job in protecting the Great Indian One-Horned Rhinoceros. They look after their tourists equally well and I strongly recommend a visit to any who can get to India.

Wildlife Biology of the Sundarbans Forests— Observations on Tigers

By

A.B. CHAUDHURI AND K. CHAKRABARTI

1. Abstract

The Sundarbans tiger stands supreme in the tiger map of the World. It is believed that they are hereditary man-eaters, fiercest, most cunning and intelligent of all tigers. The present observations include their habitat types, vulnerable operational zones, comparative casualty pattern among different professional men, casualties in various age groups of men, monthly and yearly pattern of casualty, breeding potential, food habits and other aspects of their behaviour. Such studies have never been made in the estuarine tract in the present manner and it is expected that this study will help to throw lights on many facts so far unknown about the tigers of the tract.

2. Introduction

The Javan rhinoceros (*Rhinoceros sondaicus*, Desmarest), swamp deer and wild buffaloes which were once a feature of the Sundarbans, no longer exist in the area. However, reptiles, sharks, peculiar fish, wild boar, spotted deer, monkeys and mysterious tigers abound in the area. It is a curious, anomalous tract where fish (*Periophthalmus* and *Boleophthalmus*) creep up the tree, tides in the same creek run in opposite directions, molluscs and crustacea are in abundance and high tides occur twice a day. The tigers operate in such a peculiar saline terrain and their behaviour and adaptations being unique, have made them a subject of study and research.

3. Objects and Methods of Study

Observations have been made on the tigers' (i) habitat and their principal formations, (ii) behaviour pattern, (iii) casualty pattern, (iv) breeding potential and sex ratio (v) population etc.

The methods followed have been based on (i) the measurement of innumerable pugmarks and their analysis, (ii) collected records on human casualties, time of kill, methods of kill, seasons of kill, age and profession of the persons killed and their analysis, (iii) interrogations and of replies from thousands of forest workers and their analysis and (iv) the analysis of kills of human beings and other animals observed at various places.

4. Habitat Types

(a) Plant community

The vegetation is of a poor quality, and almost impenetrable. Water-logging, humidity, salinity and regular inundations are the salient features of the habitat. *Heritiera* and *Phoenix* formations are high level forests which are either not regularly inundated, or inundated for a short period and, therefore, form an ideal tiger habitat. The forests on the sandy and sandy loam soil on the sea-shore form a special type of habitat over a very small area.

The principal forest formations have been based on the tide-level and have been shown in a tabular form in which the density of stock, principal forest formations and the tiger habitat have been enumerated in detail.

Further features on the tiger habitat are as follows:—

There is complete absence of ground flora to afford cover and shelter to the tigers. Humus is completely absent, the leaves and branches that fall to the ground are washed away at high tide leaving no chance to form a soft cushion for the rest; there is no thick-crowned bush or branchy trees to afford shade and shelter. The *Cereops* and *Aegialitis* afford side shade, and the tunnels in *Phoenix* bushes afford them best shade and shelter. At extreme high tide when the *Phoenix* areas go under water, the tigers have to lead an amphibious life. They have to be constantly on the move and cover wide areas even swimming across wide rivers. High and low tide constantly change the physical environment and the force of the current modifies the muscle formation; the saline water forms the chemical environment and the tiger has to adapt to drinking saline water (although they do prefer sweet water as evident from the pugmarks found near water holes dug artificially in the beach forests); the area is swept over by severe storms along with high currents and the wild animals have to cling to the forest floor; hard for survival).

(b) Animal Community

The animal community makes the environment exceedingly complex. Some are directly associated with the tigers and some indirectly. The spotted deer which are found in abundance in large herds form the principal food and the pigs come next. Non-scheduled food stuff is formed by crabs, monitor lizards, fish, monkeys and even birds. The association of the tiger with the land and water animals cannot be overlooked. At extreme high tides almost the entire land area goes under water and the water animals especially the sharks, crocodiles, water lizards, porpoises etc. come very near the tigers which lead, for sometime, an amphibious life. There are several species of crabs, snails, marine borers, a species of bee (*Apis dorsata*) and birds that form the animal environment of the tigers and are directly or indirectly associated with the animal.

Habitat Formations Based on Tide Level

Tide Level	Principal formation	Percentage of forest under each type	Density of crop per acre (0.4 hectare)	Tiger estimates based on count of annual kill, pugmarks and information	Remarks
1	2	3	4	5	6
(i) High (special)	Special type of Beach Forest (on sand). This area perhaps rarely goes under water. These are sandy sea-coast areas that have some plantations of <i>Casuarina</i> and mixed crops of transition zone species flanked by mangrove species.	Very small area.	Various	Good concentration vis-a-vis small area; provides breeding ground; abundance of pigs and deer.	Tiger cubs are sighted more frequently than in other areas.
(ii) Above general tide level (these areas go under water once or twice during May to October at full and new moon or at exceptionally high tides).	(a) <i>Heritiera-Phoenix</i> . Thick clumps of <i>Phoenix</i> with <i>Heritiera</i> trees scattered all over in the upper storey. <i>Nipa fruticans</i> occurs on river banks.	2%	5,000 stems	Abode of tiger; good concentration.	
	(b) <i>Heritiera-Excaecaria</i> . <i>Heritiera</i> is more common and forms an intimate mixture. <i>Nipa</i> occurs along river banks. <i>Cereops</i> forms a high proportion in the mixture. Scattered <i>Xylocarpus</i> species also occur.	2%	3,000-5,000 stems	Has incidence of kill but concentration not high.	

1	2	3	4	5	6
(c) Frequently inundated by salt water	(c) <i>Heritiera-Excaecaria-Cereops</i> . <i>Heritiera</i> and <i>Excaecaria</i> in the upper storey and dense crop of <i>Cereops</i> in the lower. Also scattered <i>Xylocarpus</i> and other species occur.	4%	3,000-5,000 stems	Has incidence of kill, but concentration not high.	
	(d) <i>Excaecaria-Phoenix</i> . Thick clumps of <i>Phoenix</i> with <i>Excaecaria</i> in the top. Interspace between the clumps provides a tunnel for tiger movement.	3%	3,000-5,000 stems	Good concentration of tiger; provides shelter, free movement and breeding grounds.	
	(e) Pure <i>Phoenix</i> . Thick <i>Phoenix</i> clumps forming dense shade, but tunnels formed in the inter-space provides shelter to tiger and allows free movement.	4%	3,000 stems	Very good concentration; provides shelter, free movement and breeding grounds.	
	(f) <i>Excaecaria</i> . These are 'Dhal' or low areas at the head of Jhoras. Trees are scattered and forests open.	2%	200-300 stems	Not the abode of tigers: Trees well apart and with practically no <i>Cereops</i> bushes.	
	(g) Pure <i>Cereops</i> . A forest of bushes hardly 2-3 metres tall. Tigers move about with difficulty but the crop gives ideal cover.	5%	500 (2-30 stems in each plant)	Very good cover for stalking its prey; saline blanks in the <i>Cereops</i> bushes are very dangerous zones for movement of human beings.	

1	2	3	4	5	6
(iv) Below tide level	(h) <i>Excaecaria-Cereops</i> . Most common and principal association in the forests; scattered <i>Xylocarpus</i> , <i>Rhizophora</i> , <i>Sonneretia</i> , etc. occur.	70%	Gnewa 100-4000 stems, Goran 500 stems	Good incidence of kill and good concentration.	
	(i) <i>Rhizophora-Bruguiera</i> . This is rather an uncommon association in general, but 3 blocks of Matla, some areas of Chulkati, Haldi and Mayadwip blocks have these forests.	4%	Various but not dense	Not the abode of tiger.	
	(j) <i>Oryza</i> (Pure)	Small area along river bank and new formation	Fresh formation	Not the abode of tiger but follows spotted deer (especially during April to June in the fruiting season of <i>Sonneretia</i>); practically none.	
	(k) <i>Avicennia-Oryza</i> . These species invade new char areas and form forests on mud-flats.	2%	Fresh formation	Not the abode of tiger but follows spotted deer (especially during April to June fruiting season of <i>Sonneretia</i>); very few.	
	(l) <i>Avicennia-Sonneretia</i> . Next to type (vi), comes this type on mud-flats.	2%	2,000-3000 stems	Not the abode of tiger but follows spotted deer (especially during April to June in the fruiting season of <i>Sonneretia</i>).	

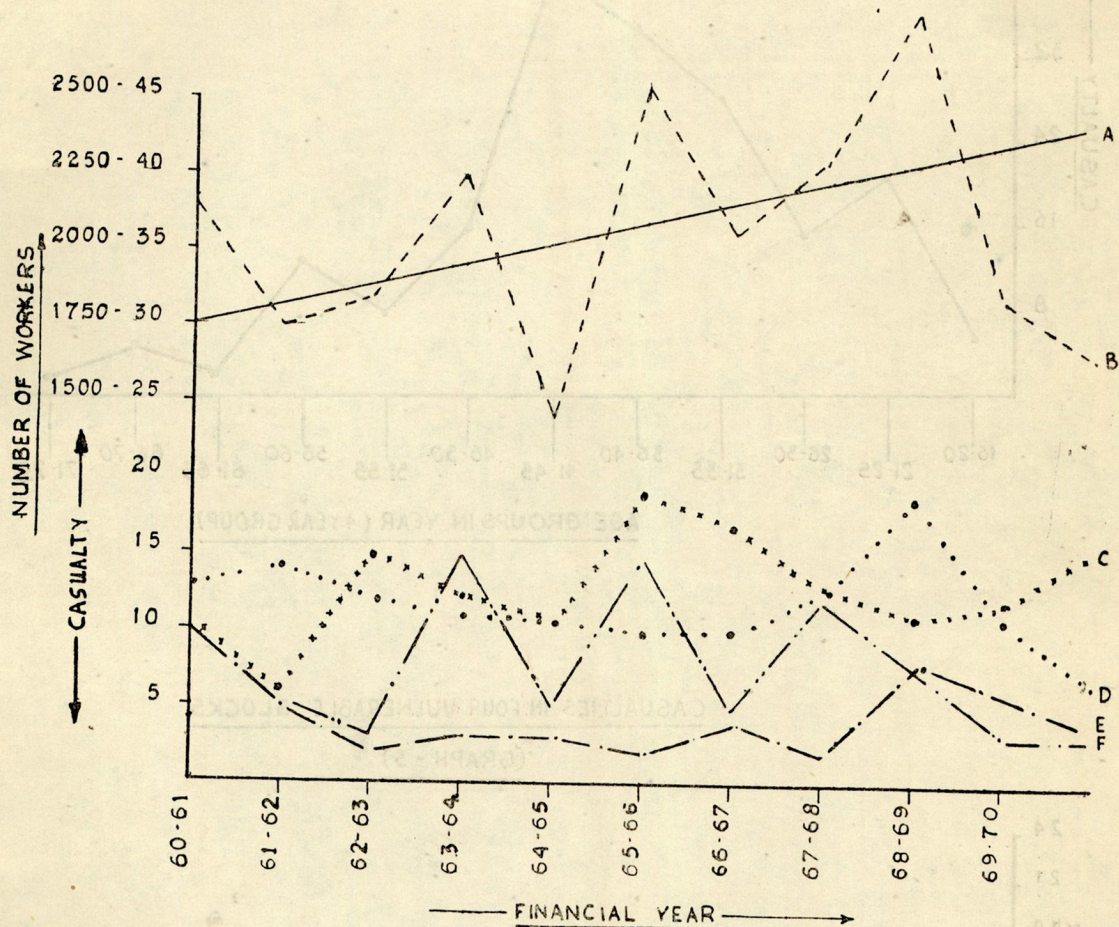
Table No. 1
TABLE SHOWING TIGER CASUALTIES
Pattern Amongst the Different Professions of Forest Workers

Profession	No. of workers per year	Persons killed in a year	Percentage of total kill	Number of persons killed for every 4,500 workers per year	Percentage casualty due to tiger	Expected Percentage class of people	Remarks
1	2	3	4	5	6	7	8
1. Coupe workers	4,580	6	16.6	6	12.50	25.00	Old age class is maximum among the fishermen. Young age class is maximum among honey collectors.
2. Fishermen	24,900	12	33.3	3	6.25	25.00	
3. Honey collectors	1,350	7	19.4	28	58.30	25.00	
4. Golpatta and Hental collectors	4,500	11	0.7	11	22.95	25.00	
Total a year	35,330	36	100.0	48	100.00		

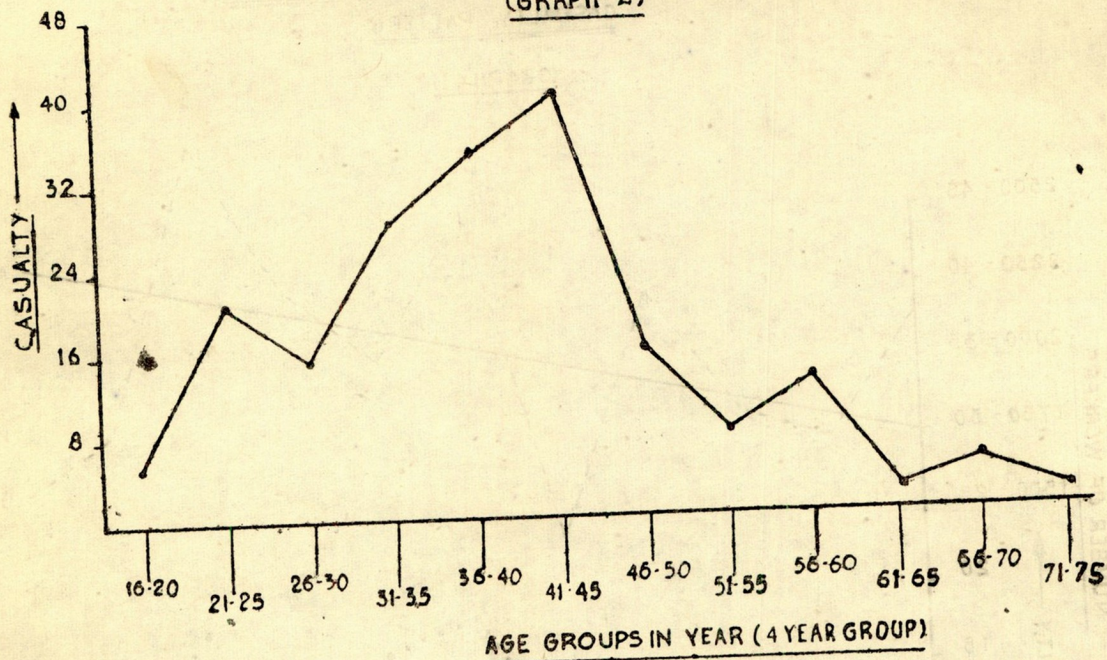
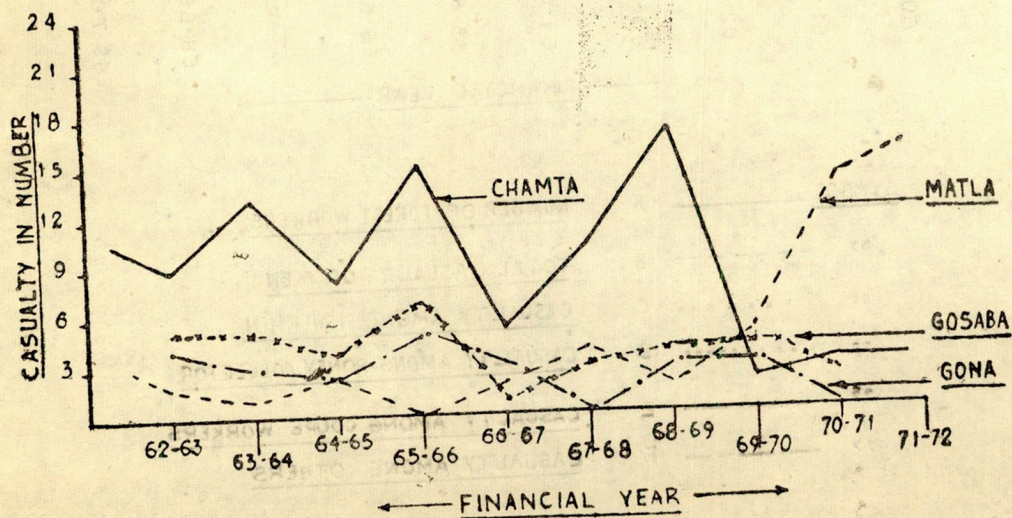
To test whether there was any significant difference in casualties amongst the various professional persons X^2 test (chi-square) was applied. X^2 was highly significant. A very high degree of significant difference was indicated. The casualties among honey collectors was significantly more than others.

PERMIT HOLDERS OF DIFFERENT PROFESSION AND
CASUALTY PATTERN

(GRAPH-1)



SYMBOL	A	NUMBER OF FOREST WORKERS
"	B	TOTAL CASUALTY OF MEN
"	C	CASUALTY AMONG FISHERMEN
"	D	CASUALTY AMONG HONEY COLLECTOR
"	E	CASUALTY AMONG COUPE WORKERS
"	F	CASUALTY AMONG OTHERS

AGE GROUP & CASUALTY PATTERN(GRAPH - 2)CASUALTIES IN FOUR VULNERABLE BLOCKS(GRAPH - 3)

5. Casualty Pattern

- (i) *Graph—1. Casualty pattern among permit holders.* This is a composite graph showing:
- The gradual (10 years' figure) increase in the number of workers in the forests.
 - The casualty pattern among total workers going to the forests.
 - The casualty pattern among the fishermen.
 - The casualty pattern among the honey collectors.
 - The casualty pattern among the timber coupe workers.
 - The casualty pattern among the other professional men.

COMMENTS:

There is a gradual increase in the number of workers in the forest (see line A). The trend of casualties, however, shows fluctuations, though the overall trend is upwards (see line B). Casualty figures among all other professional men, individually, very often fluctuate; the trend of increase in number of men among different professions, however, remained almost similar. Table No. 1 gives a detailed analysis of the pattern.

(ii) *Graph 2—Age group and casualty pattern.*

The total number of persons killed during the period of ten years were grouped into 4-year age classes and tabulated against the number of persons killed. Table 2 shows the details of the casualties.

Table No. 2

Table showing the number of workers of individual age groups and the number of casualties due to man-eaters, in corresponding age groups.

Age groups in years	No. of casualties due to tiger	No. of workers in the forests of Sundarbans	Percentage of casualties among workers	Percentage of workers in the forests of Sundarbans
1	2	3	4	5
16—20	3	1050	4.2	1.4
21—25	10	2560	10.8	3.1
26—30	7	5799	8.2	7.2
31—35	14	7843	13.8	9.8
36—40	17	6778	18.2	8.5
41—45	18	9000	18.8	11.1
46—50	8	13462	8.7	16.6
51—55	4	13000	5.3	16.2
56—60	6	14000	6.8	17.3
61—65	1	5100	1.2	6.3
66—70	2	1160	2.7	1.4
71—75	1		1.3	1.1
	91	80,660	100	100

COMMENTS:

The table shows that the maximum number of casualties was among the age group 36 to 45 which means that the middle-aged healthy people mostly, are the victims of the man-eaters. This also justifies the age old belief and observation that the man-eaters select the strongest men. To support this, an analysis of the people of different professions and their age class (average of 10 years) and the casualty pattern amongst the different age groups of forest workers are given in tables 1 and 2, respectively.

Of 35,330 persons, the age of about 25,000 (or two-third) fishermen varies from 40 to 69; the balance 1/3 belong either to the younger or older age group or both. It is, therefore, seen that most of the workers belong to older age group, but the maximum number of casualties is among the middle age group.

(iii) *Graph 3—Blockwise Casualty Pattern in four most vulnerable Blocks.*

The graphs show the pattern of casualties in Chamta, Matla, Gosaba and Gona, the four vulnerable blocks. Chamta shows regular fluctuations of human deaths, but abounds with the maximum number of tigers; the area flanked by Chota and Bara Chamta was considered as the worst area in the past. The areas near Surjamukhi and Gobdikhals near Matla 1 and 3 respectively, have been the worst depredation zones during 1970 and 1971. This shows a decreasing trend in Chamta and increasing trend in Matla and indicates a migratory tendency in the tigers from block to block.

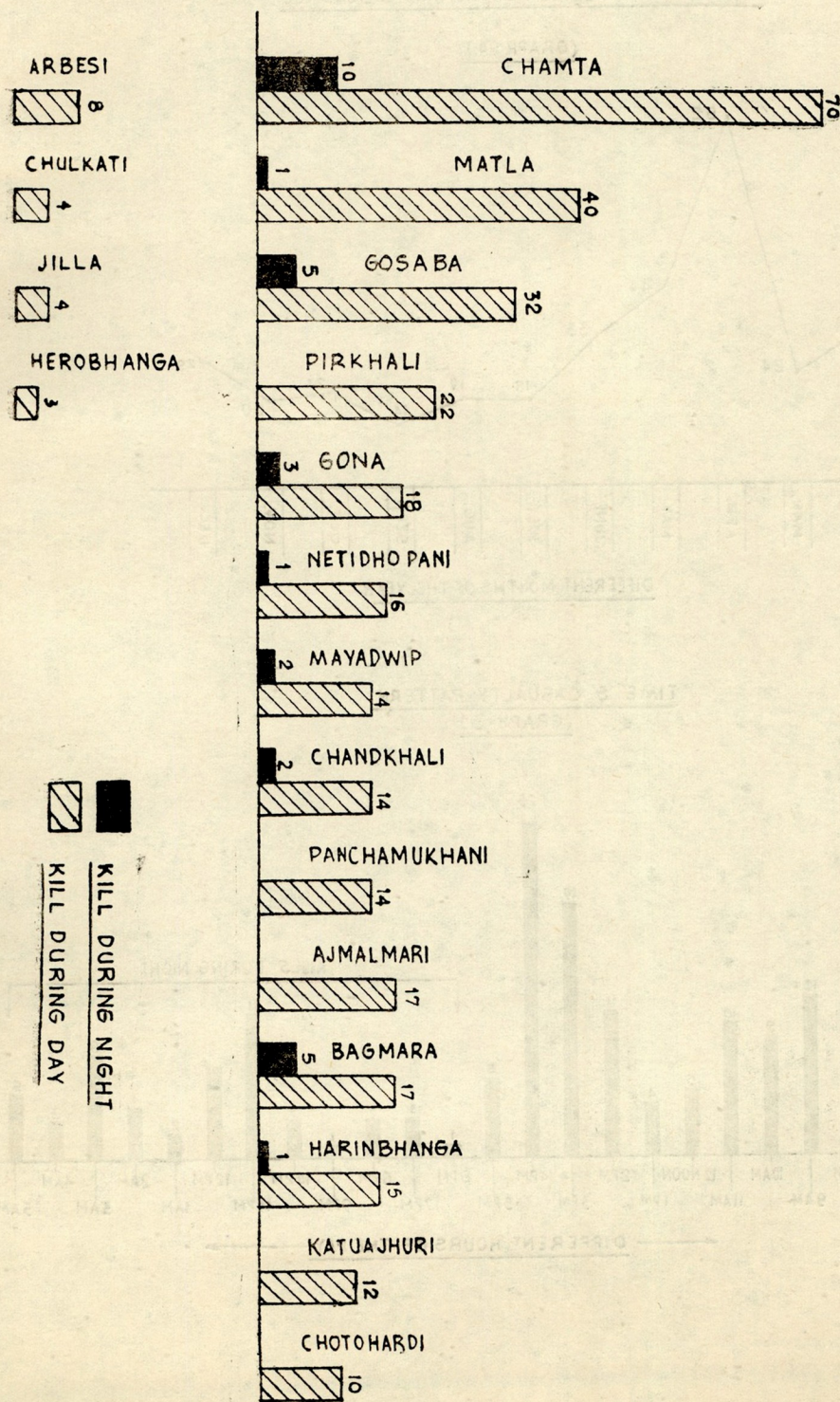
(iv) *Graph 4—Month-wise distribution*

This graph shows the number of persons killed in different months of a year. The figure in each month is the total of ten years.

COMMENTS:

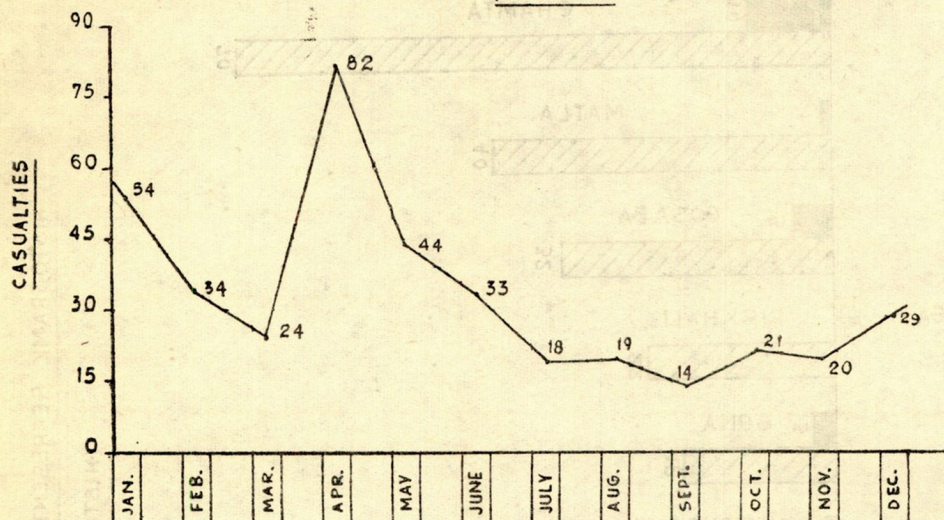
- (a) It is seen that April is the month of maximum human victims. Next comes the month of January.
- (b) The number of workers increases slightly during the winter months. During the period from 1st April to 15th of June, about 1400 honey collectors work in the forest. Obviously it may be said that a good number of honey collectors get killed in April, Why then should January come next instead of May or June? It is extremely difficult to explain this. Can it be due to infertility of either the male or female tiger leading to some physiological change and augmentation of ferocity in January!
- (c) Perhaps the declining trend in February, March, July, August and September, indicates that extreme winter and rains, inhibits the activities of the tigers.
- (d) Kills during April, May and June were as follows (during honey collection):
- (v) *Histogram No. 1—Representation of Blockwise Casualty Pattern.* This histogram illustrates the number of casualties in each block, both during the day and night.

CASUALTY IN NUMBER

HISTOGRAMIC REPRESENTATION OF BLOCKWISE CASUALTY
(HISTOGRAM No 1)

MONTHLY DISTRIBUTION OF HUMAN CASUALTIES

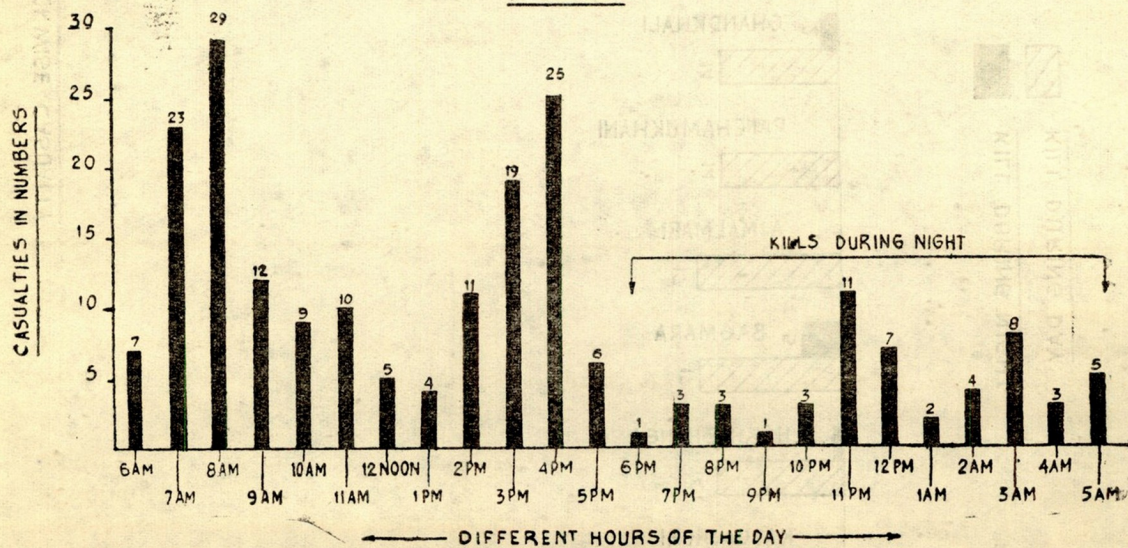
(GRAPH - 4)



DIFFERENT MONTHS OF THE YEAR

TIME & CASUALTY PATTERN

(GRAPH - 5)



DIFFERENT HOURS OF THE DAY

COMMENTS ON HISTOGRAM NO. 1

It depicts.—

- (a) The tigers ferocity, cunningness, intelligence and understanding of the human nature.
- (b) That man-eaters of these eight blocks are hereditary, and their number could be 20 to 25.
- (c) The tigers have receded from the Namkhana Range.
- (d) The number of kills in Arbesi indicates movement of tigers from Bangla Desh.

There has been a heavy concentration of man-eaters in the blocks of Bangla Desh adjoining the eastern blocks of our forests, and the indication is that the poor type of forest as in the eastern block of the Indian Union and western block of Bangla Desh have the maximum concentration of man-eaters (casualty figures justify this).

- (e) Fluctuations in the number of kills each year, in a block, record the constant movement of tigers.

Table No. 3

Year	No. of persons killed	No. of persons that worked for honey collection
1965-66	16	1,120
1966-67	17	1,225
1967-68	17	1,310
1968-69	17	1,400
1969-70	11	1,320
1970-71	16	1,530
1971-72	16	1,400

The striking uniformity in the number of persons killed for seven consecutive years suggests that the number of man-eaters is small and static. Considering the kills which are scattered over a wide area, the number of man-eaters may be 10-17 as is evident from the distribution of kills.

Statistical analysis shows that it is very unlikely that in any particular year the number of casualties during April, and June will go above 30 or below 5. The distribution of casualties with 97.50% confidence interval is 30 as the upper limit and 5 as the lower limit.

6. Food and Behaviour Pattern

The inhospitable habitat has reduced the tigers to a short and stout-legged animal. The coastal (beach forest) form is bigger but with fader colours. With 12% of the human casualties taking place during the night, these tigers may be said to be diurnal. They are ferocious, agile, strong and cunning. They have a diabolical understanding of human nature, and avoid encroachment of human habitation, though sometime they do even this.

These tigers drink saline water, eat deer, pig and also crabs and fish etc. Opinion however differs whether they take honey in the honey season (April-June) but they have been sighted to pounce upon honey combs and bolt away from the vicinity. They eat the entire skull bone including all portions of human bones. The horns of deer have also been found partly eaten. Feathers of birds have been recovered from their stomachs. The tigers visit the Sajnakhali Sanctuary frequently, to eat birds during the breeding season, and the water and land monitors.

According to reports, the tigers attack from behind with a deep bite on the right side of the neck and drag the human bodies to various distances of about 200 metres or sometimes even to 1 to 3 kilometres. The bulk of the tiger's diet, however, comes from spotted deer and pigs. Instances are there when one tiger killed 2 to 3 persons on the same spot. The stomach is eaten first and then the rest of the body. Out of the total kills, only in 28.5% of the cases was the dead body recovered. This shows the ferocity of the man-eaters and their determination to devour the human body.

Other special features of the tigers are as follows:--

(based on innumerable encounters by permit holder with the tiger).

(i) The tigers are less often sighted though the pugmarks are found everywhere in the forests. The maximum incidence of pugmarks were found in Mechua and Chaimari areas of beach forests, (ii) they prefer sweet water as is evident from the pugmarks near the water holes which the permit holders dig in the sand, (iii) they devour the entire body within a few hours of the attack, (iv) irrespective of the force of the current they swim straight across a river at right angles to the current, (v) they are able to take a human victim from a boat, (vi) they have never been captured in a cage, (vii) dead bodies buried on the forest floor have been found to be unearthed and eaten by the tigers, (viii) the human casualty rate is neither related to the density of persons working in the forests nor on the density of deer population and (ix) the maximum number of human casualties in the Chamta, Matla and Gosaba blocks suggests that the tigers in this central zone of the forests of western Sundarbans are most dangerous; salinity of the water increases more from east to west, and it is likely that this salinity induces some physiological changes in the body but the concentrated zone of operation cannot be explained adequately.

Based on all these facts the behaviour of the Sundarbans tiger has been classified in a pattern as detailed in the Chart I.

Graph 5.—Time and Casualty pattern

This graph represents the hourly pattern of casualties in a day (10 years average).

COMMENTS

It is seen that the maximum activity of the tigers is in the afternoon (3 p.m.) and in the morning (8 a.m.). This may be owing to the fact that the tigers have a diabolical understanding of human nature. The workers that set out for work in the morning get killed immediately after they enter the forest; the man-eaters, perhaps, anticipate their prey and strike at an unguarded moment. Similarly, in the afternoon when the workers return to their boats, the man-eaters seize the opportunity to get at the workers.

Casualties at night.

A number of people get killed at night in their boats. It is seen that the maximum incidence of kill centres round 11 p.m. The man-eaters pick their human prey from their boats. The workers go to sleep in early hours and are in deep sleep around 11 p.m. when the tigers seize this opportunity to get at them. It is only when the man-eater jump out of the boat with the victim that the other inmates know what has happened. The boats do not tilt when the mighty 300 pounder jumps into the boat (reasons described later). Such kills cannot be recovered.

7. Assessment of Population.

Record of kills during the past ten years show the blockwise distribution as follows:—

Chamta	...	80	Netidhopani	...	17
Matla	...	41	Ajmal mari	...	17
Gosaba	...	37	Mayadwip	...	16
Pirkhali	...	22	Chandkhali	...	16
Bagmara	...	22	Panchamukhani	...	14
Gona	...	21	Arbesi	...	8
Chulkati	...	4	Harinbhanga	...	16
Jhilla	...	4	Katuajhuri	...	12
Herobhanga	...	3	Chotahardi	...	10

Total:—360

This shows that the annual number of kills is 36. Non-official circles, however, put the figure three times the official figure. This is owing to many unauthorised intruders getting killed which are not recorded nor reported to the police. This cannot be accepted as there is no evidence of such intruders. Pugmarks have been sighted all over the blocks by the honey collectors and others. More than 500 pugmarks have been measured all over the forests and the sizes reveal that (i) most of the tigers are middle to old aged, the diameter of pugmarks varies from 11 cm. to 16 cm. (ii) the proportion of male to female is 1 : 3 and (iii) the young age class is conspicuously absent.

The above 36 kills are distributed over about 10-15 blocks in a year showing the presence of at least one man-eater in each block. All the tigers in the blocks are not man-eaters (this has been verified from reports and observation) but the pugmarks of different sizes show the presence of 3 to 4 tigers in a block as verified only from the examination of pugmarks in the fringes of the forests. This brings the population to 60 which can be taken confidently as the minimum level. Further, it so happens that in a few blocks, several persons are killed within a short time, sometimes simultaneously or on successive days. This reveals the presence of several man-eaters in a block, one or two of which may be man-eaters. Tigers have been sighted crossing over to the adjoining villages; also several harmless tigers have been sighted in the blocks of working coupes. These reveal (i) the presence of at least 6 to 7 tigers in a block, (ii) all the tigers are not man-eaters (iii) and old age and physical disability do not lead the tigers to become man-eaters. Had all the tigers been man-eaters there would have been many more casualties. There are some tigers which chase human being, sometime injures them but do not kill them; this type of tiger together with the aggressive man-eaters described earlier in this paragraph number about 20-25 or one fifth of the total tiger population. The number of tigers, therefore, can be assessed at about 112 (18 blocks $\times$ 6 tigers in each block i.e. (108) or 23 man-eaters $\times$ 5 i.e. 115).

Another fact is clear that the concentration of kill is more in the blocks in the central position viz. Chamta, Gosaba and Matla. There are plenty of deer in this region and irrespective of the number of human beings working in the area the human predation is maximum.

8. Food and Assessment of Tiger and Deer Population

Accepting the tiger population at 112, the annual requirement of meat should be $112 \times 365 \times 10$ kg. (daily requirement per head is 10 kg.) or 4,08,800 kg. Most of this meat is from the dominant mammal species i.e., the spotted deer, the wild boar being the next dominant species. Taking the average weight of a deer killed at 60 kg. the number of deer required annually is $4,08,800 \div 60$ kg. or 6,813; a more accurate figure for deer may be 5,000 the balance 1,813 being wild boar. But the Sundarbans tigers take to other types of food like monkeys, monitor lizards, crabs, fish, crocodile and birds. It is also very well within the observers limit of count to justify that annually at least 6,000 fawns survive out of many more born to the deer, to keep the population at a steady level; observations and spoors count also justify the presence of about 6,000 hind and half that number of stage. The spotted deer population in the 22 blocks where the tigers have operated for the past 20 years may therefore be assessed at about 10,000 or 4 to 5 deer per sq. km. Spoors of deer are sighted all over the forests throughout the 700 square miles. This number therefore justifies the tiger population as 112.

9. Comparative situation in West Bengal and Bangladesh

From the available information it is gathered that 16 persons are killed by the tigers in the Bangladesh portion where the total number of tigers has been assessed at 100. In the West Bengal portion therefore (on the basis of area to number of tigers) there should be 225 tigers. This has to be established as there is no physical evidence or any proof from casualties or tigers sighted. One point that supports this number is that all tigers are not man-eaters.

Mr. Guy Montfort in his book "The Vanishing Jungle" assesses the tiger population of Bangladesh Sundarbans at about 50 to 100 and refutes the forest officers' figure of 300. He records 82 deaths in Bangladesh Sundarbans during 1963 to 1967. Our death figures during this corresponding period is 188. Another point worth noting is that while 20 tigers have been shot in the Bangladesh territory of the Sundarbans during this period, only 2 have been shot in West Bengal Sundarbans (12 shot in 10 years).

Old records show the following figures for in the undivided Sundarbans.

<i>Year</i>	<i>Men killed by man-eaters</i>	<i>Man-eaters shot dead</i>	<i>Remarks</i>
1881-82	161	3	Column 3 shows the
1883-84	168	8	tiger killed
1907-08	120	9	mostly in the
1911-12	112	61	portion now in
1914-15	79	86	Bangladesh

This shows that the casualty figure has not come down very much since 1914-15 in the undivided Sundarbans, but much less tigers have been shot, especially in the western portion.

It is reported that 16 persons are killed in a year in Bangladesh when the total number of tigers has been assessed at 100; in the same proportion the tiger population should be 226 (36 persons killed a year) in West Bengal. This is not so as otherwise there would have been more kills and more tigers would have been sighted. If the number be as large as 226, then the obvious conclusion would be as follows:—

- There are few hereditary man-eaters,
- Many tigers avoid men,
- Many tiger attack men when their operation areas are encroached upon, and
- Tigers are habitual wanderers as the casualties in a particular area fluctuate.

Behaviour pattern of the Sundarbans Tiger
(All have an inherent tendency and potentiality of man-eaters)

28

Inherent and designed man-eater (Kills man at sight or hunts men)		Undesigned man-eater (Kills men when they encroach upon their den)	Circumstantial man-eater (given a chance, it avoids man unless hungry, injury or old age)
25% of tiger population.		15% of tiger population	60% of tiger population.
Aggressive man-eater (80%)	Lusty and adventurous man-eater. (20%)	Mostly the honey collector or dry firewood collector. Dead body rarely recoverable.	
Most daring and cunning (10%) (Nocturnal & swimmer to boat. Casualty a certainty.)	Ferocious (90%) (Charges at sight). Casualty a certainty. Hental and honey collectors are victims mainly.	Encroaches on habitation for cattle, does not kill men. (10%)	In forest habitat; not aggressive. (Generally kills men when extremely hungry and other natural animal food is not readily at hand). (90%)
Deadbody not recoverable.	Deadbody partially recoverable.	Timber Coupe workers, Honey collector etc. Dead-body partially recoverable.	
All categories of permit holders.			
Responsible for 70% of human casualties.		Responsible for 20% of human casualties.	
		Responsible for 10% of human casualties.	

N. B. Only 28.5% of the total dead victims are recoverable.

10. Breeding potential and sex ratio

The peculiar nature of the terrain makes it impossible to follow any standard method of population count. It is, therefore, extremely difficult to census the sex ratio and breeding potential in the Sundarbans.

Interrogation of about 3500 persons, many of whom have spent more than 20 years in the forests has indicated the sighting of only a few cubs. Out of 450 pugmarks only in 2% of the cases have pugmarks of tiger cubs been sighted, which lead to the conclusion that:—

- (i) there is a declining trend in the fertility or
- (ii) wide interval of fertility cycle, or
- (iii) death or destruction of young cubs, or
- (iv) low female population (ratio of male to female as evident from the pugmarks is 3:1).

The above situation depicts a gloomy picture about the future of the tigers in Sundarbans; only few tigers are shot every year but even then the number is not increasing. The identification of the sex from the pugmark does not follow the same pattern as elsewhere. Impression of the pugmarks taken on paper show that in the female the paws are closely set, while in the male they are some distance apart (the permit holders identify the sex by this same method).

11. Salinity and Tiger Behaviour

Salinity cannot be one isolated factor responsible for the peculiar behaviour of tigers. Analysis show that the salinity of water and soil in the sea-face blocks, centrally situated blocks and block in the interior do not vary as much as they vary from eastern to western blocks. The high casualty rate in Chamta, Matla and Gosaba blocks would obviously be more than any blocks in the east including those in Bangladesh; but their salinity is less than any area in the Namkhana Range in the west; yet the maximum casualties are in these three blocks.

As such it may be concluded that the behaviour pattern is governed by cumulative action of physical and chemical environment. Deer population (animate environment) is high in Gosaba and Matla blocks but less in Chamta and as such deer concentration is not a guiding factor for higher casualty figures and the scarcity or abundance of food are not directly related to the casualty figures.

12. Conclusion

1. The present state of tiger population in the Sunderbans calls for the adoption of drastic and realistic measures of enumeration, protection and destruction. Some notorious man-eating tigers have to be destroyed.

2. There is scope for the study of the effect of salinity, strong currents, wind and food on the morphology and physiology of the animals.

3. Further research is necessary on the breeding potential, age and size and how to adopt protective measures to reduce the human death rate.

Supplementary Note

Analysis of pugmarks and population study

A random sample in strips along the periphery of nine blocks was made and pugmarks measured and recorded in a statement made for this specific purpose.

The sizes so obtained were grouped in five size classes as follows:—

	Length $\times$ Width less than	in centimetres
Class I	7 $\times$ 6	„
Class II	7-10 $\times$ 6-10	„
Class III	10-15 $\times$ 10-15	„
Class IV	15-20 $\times$ 10-15	„
Class V	15-20 $\times$ 15-20	„

In each of the above classes, the proportion of tigers was found to be 1, 1, 9, 7 & 1 respectively. The pugmarks in the study area also revealed the presence of 13 tigers in Arbesi, 3 in Panchamukhani, 2 in Jilla, 2 in Harinbhanga, 2 in Chandkhali, 4 in Chamta, 6 in Matla, 5 in Bagmara and 1 in Gosaba or 38 tigers in the 9 sample blocks, or say 4 to 5 tigers in each block on the average.

Pugmarks of the same size were counted as a single tiger though several tigers of the same size are likely to be in each block. This exactly agrees with the authors' finding detailed on page 13, as the study did not account for aggressive tigers that reside in dense forests and the present finding could include 1 to 2 more tigers in each block, bringing the total to 6 to 7 in a block which is probably the minimum number in a block.

The study also showed that Bagmara block in the beach forest has tigers of 9 $\times$ 8 cms. size; Chandkhali, Matla and Arbesi blocks recorded 18 $\times$ 16 cms., 17 $\times$ 14 cms. and 18 $\times$ 13 cms. sizes; Chandkhali, Bagmara and Gosaba recorded 6-10 $\times$ 7-10 cms. sizes; Arbesi, Panchamukhani, Jilla, Harinbhanga, Chamta and Chandkhali recorded 10-15 $\times$ 10-15 cms. sizes; Chandkhali recorded 15-20 $\times$ 15-20 cms. sizes; and Chandkhali, Chamta, Matla, Arbesi and Panchamukhani recorded 15-20 $\times$ 10-15 cms. sizes.

The conclusions are that small sized tigers are rare in the forests and the total population of 112 assessed though a conservative estimate is very reliable.

The Ban on Tiger Hunting—An Evaluation

By

GIRI RAJ SINGH

The ban on tiger hunting in India, is now well over two years old. How the resulting gain or loss in tiger population is to be assessed is beyond comprehension. The long promised census of tigers is still awaited. No tiger census on an all India basis has ever been carried out, so it will be impossible to judge from any future census, what effect if any, the 'Ban' has had on the tiger population. The issue is further confused by frequent write-ups by some of our so called conservationists and even by some visiting foreign conservation experts, claiming that twenty years ago there were 40,000 tigers in India and at present only 2,000 are left. Since there has never been a tiger census on an all India basis, one can only conclude that these figures are the product of a fertile imagination. There is no doubt that these figures are quite baseless and incorrect. Our local people have no right to put out these irresponsible figures; the foreign visitor can to a certain extent be excused, as he (the visiting foreign conservationist) is usually given a conducted tour of some of our Game Preserves, and an official or semi-official version of the tiger situation. He never gets the opportunity of visiting outlying forest areas on his own, or of meeting well informed local people.

In spite of the ban on tiger hunting, factors working against the tiger are as active as ever, if not more so. The destruction of wild life habitat still continues unabated on a large scale, both officially by forest departments and unofficially by others. Bigger and better net work of roads constructed in forest areas, make it easier for the poacher to carry on his activities. As it is, due to the ban on hunting, the poachers have been encouraged and have had a free hand in the absence of legal shooting permit holders, whose presence in forest areas did have a definite restraining effect on poachers. Most states of India have excellent hunting and wild life laws and rules, which are modified from time to time, with the result that our wild life laws are just as good as those found in any other part of the world. The enforcement of these laws is our main problem. Even in places such as the State of Uttar Pradesh, where wild life laws are comparatively better and where the wild life unit of the State Forest Department is much better organized than in other parts of the country—law enforcement suffers and is handicapped due to the paucity of much needed funds, resulting in lack of efficiently trained staff so essential for law enforcement in forest areas.

To the man-in-the-street it seems logical that to have more wild life you must stop killing it for sport. This has lead to the belief that the ban on tiger hunting is a sure way of preserving tigers. Ecological ignorance is the main reason for this belief. It is a well established fact, as proved by experiments in U.S.A. etc , that sport hunting, well regulated and

controlled properly, cannot threaten wild life species. The main factor responsible for fluctuations of wild life populations is the quality of the environment. This is rather difficult for a lay-man to grasp. The killing of an animal by a hunter is dramatic and easy to understand, but the deterioration and destruction of wild life habitat is not so easily seen or understood by the untrained eye. For example, how many people in India (who have heard so much about the ban on tiger hunting) realize or know what vast areas of our best wild life habitat have been completely destroyed in the past few years, and that this destruction still goes on unabated. How can tigers or any other wild life be expected to survive when their very home is being destroyed. In parts of Northern India, tigers have already taken to living and breeding in sugar-cane fields where they find better cover than in the forests, but where they also become easy prey for the poacher.

If the ban on hunting of an animal was the best solution to save it from extinction, then by now the country would have been overrun by the Indian lion, the hunting of which has been banned for almost fifty years. But the fact is that the lion population of India has gradually but steadily decreased, due mainly to disturbance and encroachment of its habitat, and of course due also to the activities of poachers and the non-enforcement of wild life laws. What most people don't seem to realise, and those who do realise it, refuse to admit—is that just as a given area can support only a limited head of cattle, so a given forest area can support only a limited number of wild animals. Tigers are not gregarious animals, each individual tiger must have a definite area of suitable habitat to live in and survive. No one can force two or more tigers to live in one locality that is scarcely big enough to support one tiger. So unless urgent and immediate steps are taken to safeguard wild life habitat, no tigers or any other form of wild life can possibly survive.

We are all beholden to The I.U.C.N. (International Union for Conservation of Nature and Natural Resources) and The World Wild Life Fund for taking an interest in our conservation problems. But so far this interest seems to have been restricted to the much talked of ban on tiger hunting, and efforts for a tiger census, the latter has not yet, even after two years, born any fruit. It is most unfortunate that the main cause (destruction of habitat) of the depletion of tigers and our other wild life, has been completely ignored by all concerned. This is probably due to the fact that all visiting I.U.C.N. and World Wild Life Fund representatives have so far only heard the official and semi-official version, and have had only conducted tours in our forests. I have yet to hear of or see any foreign expert who has gone off on his own to our remote forest areas (not Wild Life Preserves) where he could see the state of the wild life habitat himself and where he could talk to the local people and hear their side of the story. So far, the entire blame for depletion of wide life is being forced on to the shoulders of hunters and poachers, in an effort to confuse and side-track the main issue and to find an alibi for those who are responsible for the wholesale destruction of wild life habitats, which is the main and real cause of the depletion of the wild life population of the

country. There is no foundation for the belief that genuine hunters are responsible for the reduction of our wild life in numbers. Such hunters are honest law abiding citizens who observe game laws and hunt on permits legally issued to them. Even poaching is actually only marginally responsible for reduction in wild life. Poaching is after all an illegal act and, while law enforcement is certainly not what it should be, there is no reason to believe why poaching cannot be controlled by proper law enforcement though it may not be possible to completely eliminate it. But what seems quite uncontrollable, and what is really responsible for decreasing our wild life population is the officially sanctioned and approved policy of whole-sale destruction of the wild life habitat. At present there seem to be no indication that there is going to be any change in this policy in the near future. So the future of the Indian wild life is certainly not too bright, to put it mildly.

Government of India have instituted a training course in Wildlife Management at the Forest Research Institute & Colleges, Dehra Dun. This course is of 6 months duration but is likely to be enhanced to one year. The first course was conducted in 1970 and the fourth is to start on the 1st September, 1972. About 30 persons have undergone this post-graduate training programme in Wildlife Management, most of them being foresters from the professional cadres of the State Forest Departments, with an interest in wildlife conservation. They are now in responsible positions in the wildlife organizations within the State Forest Departments and will thus form a cadre of professionals who would conduct both research and development projects on wildlife conservation.

The Hispid Hare

Caprolagus hispidum (Pearson, 1839).

By

JOHN TESSIER-YANDELL,
FRGS, FZS.

Two of the most exciting events for naturalists in 1971—certainly in India—were the rediscovery of the pygmy hog (*Sus salvanius*) and the hispid hare (*Caprolagus hispidum*) in the Mangaldai district of Assam in late March/April of that year. In my paper in 'Cheetal' Vol. 14, No. 3 for December 1971, I dealt with the former animal, mentioning briefly that the rediscovery of the hispid hare had been coincidental to that of the pygmy hog. In this short paper I propose to elaborate on that statement.

Background

As indicated in my reference to Balakrishna Seshadri's book "The Twilight of India's Wild Life", the hispid hare was also feared to be extinct. The status category given in the Red Data Book published by the Survival Service Commission of the International Union for the Conservation of Nature and Natural Resources as at June 1967 is, as was the case of the pygmy hog, 4 (a)***, indicating a critically endangered species upon which insufficient data is available upon which to base reliable assessment; the maximum listing below known extinction. It is now to be anticipated that the listing will be changed to 4 (a), indicating indeterminate.

History

Although little reliable data exists on this animal it has not been uncommon in the past. As mentioned by Pradeep Mishra in his short paper in "Cheetal" Vol. 14, No. 1 for June 1971, Shebbeare recorded seeing numbers in the Goalpara Forest Division of Assam in between 1907 and 1911, but also recorded their sparseness in Bengal where he made only one positive identification.

However, Lt. Col. Alban Wilson, who was stationed at Naini Tal for some years, writing in his reminiscences published in 1924, said that during a shikar trip to Oudh "the hispid hare was quite common in this part of the country.....the mahouts killed quite a number of them by throwing sticks at them as they darted out from under the elephants feet". Col. Wilson also states that the hares were very good eating. This unfortunate fact, coupled with the comparative ease with which they could be killed, as in the case of the pygmy hog, has undoubtedly contributed to their rarity. The last positive identification

was made in 1956 when a German Zoological team collected a single specimen at Jamduar, again in Goalpara.

Distribution

Most authorities list this as being from Uttar Pradesh along the Himalyan foothills to Assam, and extending southwards as far as Dacca. The Indian Field Shikar Book 1928 includes Tipperah. It is unfortunately certain that this has been considerably reduced by the inroads of civilisation.

Rediscovery

This was not entirely fortuitous. When discussing the pygmy hog with E.P. Gee in 1965, he had mentioned that he hoped that these animals might be found in the same area in which he thought the pig to exist.

Accordingly, when initiating the endeavours detailed in my previous paper, which ultimately resulted in the rediscovery of the pygmy hog, the possibility of also catching the hispid hare in the same net was not neglected, and due publicity was given to this.

Capture

That we had been wise to take this precaution was displayed when the pig started to come in after the forest fires in late March 1971, in Assam. On the 22nd April 1971 a single specimen was brought in to Warinder Singh at Attarekhat.

Observation

Most authorities are agreed on the description of the hispid or harsh-furred hare, otherwise known as the Assam rabbit. The following is that given by J.G.C. Mallinson, Deputy Director of the Jersey Wildlife Preservation Trust, who came to Assam in May 1971 on behalf of the Fauna Preservation Society, to report and advise on the pygmy hog capture. At the time of his examination the specimen had been in captivity for four weeks. It was an old buck, which had obviously at some time been in a trap, as its left forefoot was missing. When caught it was otherwise in good condition.

"The most distinguishing characteristic of the hispid hare is the small size of the ears. The colour of the pelage is dark brown and blackish with numerous scattered whitish bristly hairs. The dimensions of the adult male examined were as follows: nose tip to base of tail 18"; shoulder height 7"; tail $1\frac{1}{2}$ "; ear $2\frac{1}{4}$ ". The specimen was housed on an earthen floor, and as Tate (1947) states, that although these animals are reputed to make burrows, the claws seem too long and slender for digging. There had be no signs of the specimen doing any digging during its month of captivity, although it has proved to be of a nervous disposition, and in common with the majority of *Lepus* species, has an extreme tendency to flight when alarmed".

To this description should, I think, be added, as reported by other authorities, and from my own personal observation, another particular characteristic. This is the comparatively small size of the hind limbs. Hares, in general, have extremely well developed hind legs. The hispid hare does not. It may well be that it is this fact that has given it the alternative name of Assam rabbit, although as is known that there are no true rabbits indigenous in India.

Development

It is well known that the *Lepus* species are notoriously difficult to maintain in captivity. As Mallinson has stated, they are of extremely nervous disposition and tend to do themselves damage in consequence. The single specimen caught in April 1971 proved no exception and died shortly after Mallinson's visit. Nevertheless, the continued existence of this animal has been established. In his report to the Fauna Preservation Society Mallinson has recommended a comprehensive evaluation of the habitat of the pygmy hog, and the institution of a professional capture programme. He has also recommended the inclusion of the hispid hare in this programme. If this proposal is fulfilled and young animals captured, their continuation may be assured.

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Neither of these exciting captures would have been achieved without the splendid co-operation of my Planter friends in the Mangaldai area of Darrang District in Assam, and in particular that of Richard Graves.

Status of the Asiatic Lion (*Panthera leo persica*) in Gir Forest

By

R.S. DHARMAKUMARSINGHI

It is known that the last remnants of the Asiatic lion now survive in the Gir forest, in Kathiawar of the Gujarat State in India. (See map). The Gir forest is a conglomeration of low hills covered by dry mixed deciduous forests and scrub. Small rivers emanate from the hills; these are dammed to serve as irrigation tanks. So much has been written in detail on the Gir forest and its lions that I do not intend repeating it all.

Having seen the Gir forest when I was 12 years old, and having served as Honorary Game Warden and Adviser to the erstwhile State of Bhavnagar for 15 years and as a Regional Secretary for Wild Life for the Indian Board for Wild Life for twenty years, I feel, I may be permitted to express my views on the status of what is now often known as the 'Gir Lion'.

During the period from 1928 to 1938, most of the Junagadh Gir appeared to me like a wilderness area. The Junagadh Durbar, although having taken the advice of some retired forest officers, had not commenced to work the forest seriously on a sustained yield basis. M.A. Wynter-Blyth, writes "The Gir forest has been so strictly preserved that for many years it has been a *terra incognita*, except to the very few". (JBNHS. 48-493).

The lion population which had been given complete protection by the Nawab of Junagadh since the end of the last century, was estimated in 1900 at about 20 animals and in 1913 at about 31. Sir P.R. Cadell, Administrator Junagadh, estimated it at 50 lions in 1920. From 1912 onwards, some lions were hunted in neighbouring states. By the early thirties, the population reached a stage when the Nawab of Junagadh allowed few lions to be shot by State Guests, and earlier, a few specimens were collected for the American Museum of Natural History, New York.

A census of lions taken by the Junagadh State Forest Department in 1936, purported a figure of 287 lions, (See appendix 1). This did not include lions in adjacent areas.

Table 1

A census was held in 1936 with the following results:—

Division		Lions	Linonesses	Cubs	Total
Visavadar	...	19	7	5	31
Sasan	...	22	27	11	60
Talala	...	18	20	24	62
Jamwala	...	46	15	7	68
Jasadhar	...	38	22	6	66
Total		143	91	53	287

(Source: Journal of the Bombay Natural Society, Vol. 48. p. 495.)

Controlled lion shooting was already in progress, yet the lion and its prey continued increasing. The main duties of the Junagadh forest department then were, to give the lion full protection and allow its prey to multiply.

The Gir forest is often confused with the Girnar forests some 18 miles to the north of the Gir hills. This isolated mountain area represents the Girnar which is 3666 ft. above M.S.L. and is covered at the base by a belt of teak (*Tectona grandis*) and other forest trees. Lions often visited this area, as game such as sambar (*Cervus unicolor*), wild boar (*Sus scrofa*), nilgai (*Boselaphus tragocamelus*), and four-horned antelope (*Tetracerus quadricornis*), were plentiful. The leopard (*Panthera pardus*) was not uncommon. Lions do not regularly visit this area now.

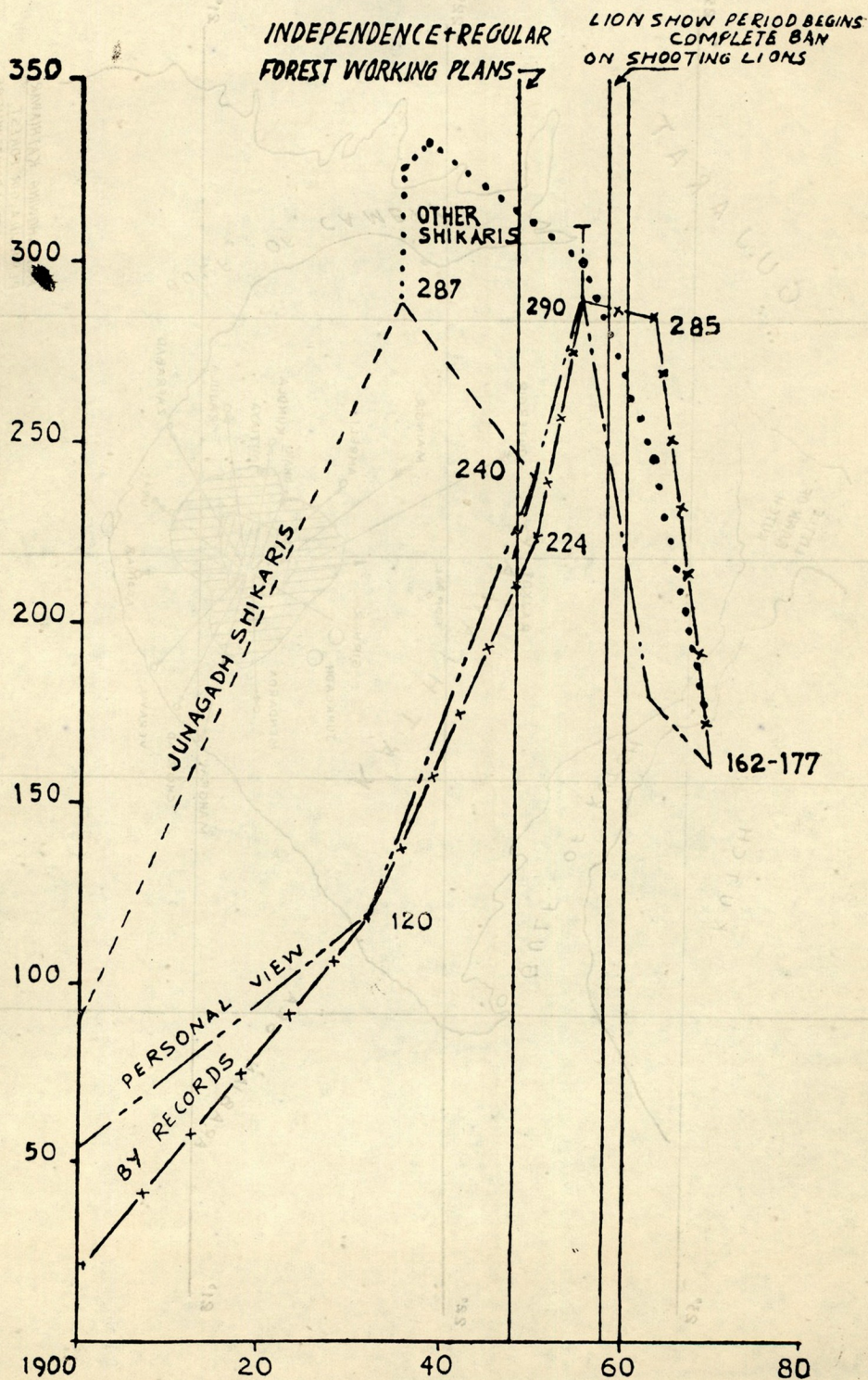
In the Pre-Independence period, some of the surrounding areas of the Junagadh Gir belonged to erstwhile princely states of which Baroda had the larger share. On the extreme eastern sector, the Bhavnagar Durbar had a small Lion Reserve at Mitiala where lions came as mosoon and winter visitors and later bred there.

The yardstick of estimating the lion population is in its distribution. Reports of movements of lions were given to me by friends, 'Maldharies' (herdsmen) and shikaries who lived close to and in the Gir. When the lion population increased, more lions were seen on the periphery of the main Gir, and they remained in such areas for longer periods. As the population grew, it spread. In short, when the carrying capacity of the main Gir overflowed, the lion and its prey spread to adjoining areas, such as, Baroda Gir, Mendarda (Bilkha), Andhania (Jetpur-Pithadia), and the smaller feudal states upto Mitiala (Bhavnagar).

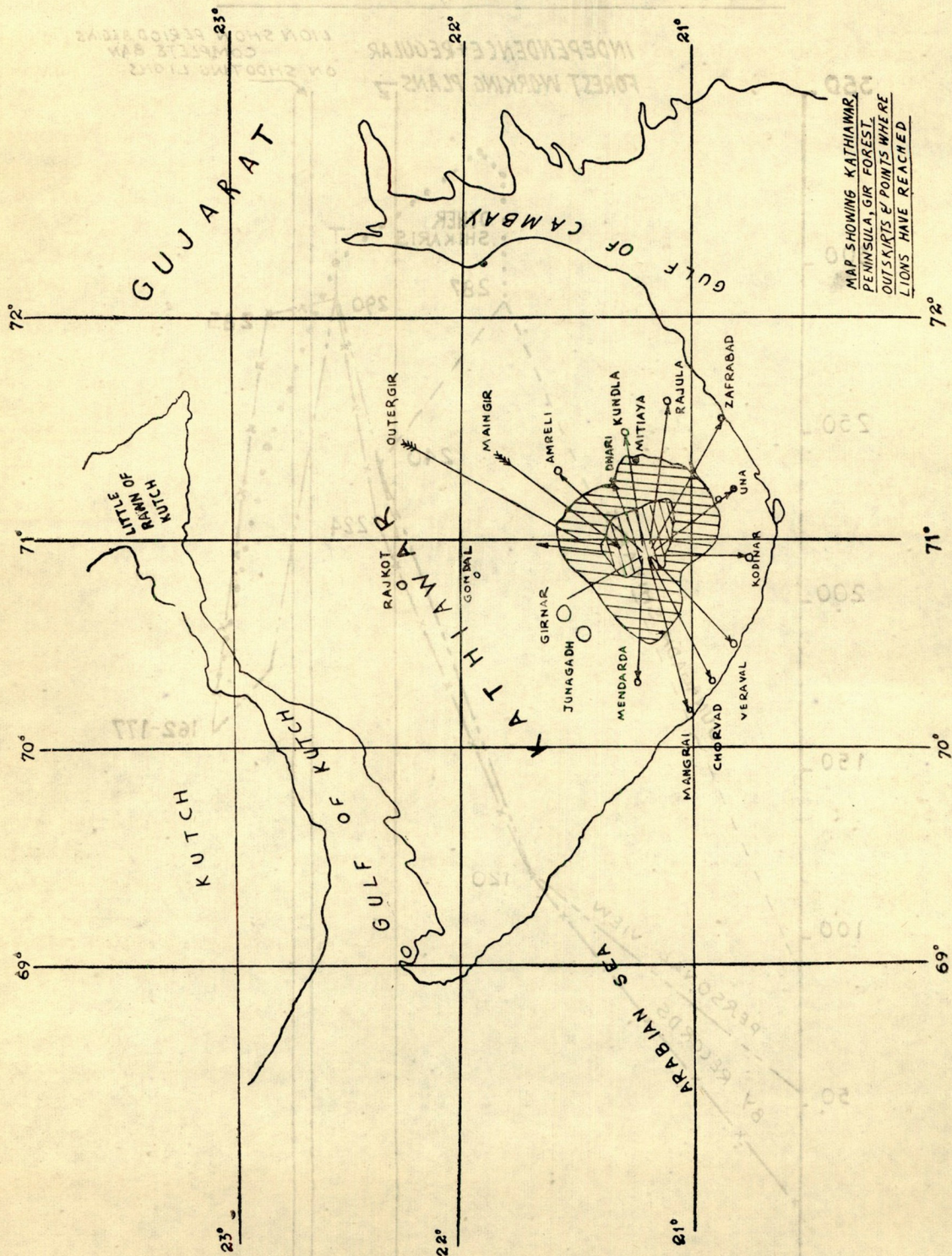
GRAPH OF GIR LION POPULATION

(HABITAT AREA APPROX 700 SQ. MILES)

SCALE:- 1"=20 YEARS HORIZONTAL, 1"=50 NOS VERTICAL



CHEETAL



On the coastal orbit, lions reached Veraval, Chorwad, and as far as the euphorbia forests of Mangrol. On the eastern sector, Zafrabad; and as far as Kundla and Rajula (Bhavnagar) beyond Mitiala. Some lions were recorded in the north in Gondal territory. (See map).

The big game in all these areas, specially nilgai and wild boar had increased to enormous size and were causing unlimited damage to cultivation despite lion and leopard predation and controlled shooting. In the forties, both carnivores had increased to full capacity and their prey multiplying. However, sambar and cheetal (*Axis axis*), had not increased and spread so much, being somewhat checked by man, predators and habitat restrictions. But in the Girnar, sambar reached saturation with much increase in wild boar.

In the past, there was no effort made to census wild life except for the 1936 Junagadh State effort. Experienced Pugees (Head Shikaris) of the states of Junagadh, Baroda, Bhavnagar and some Kathi states were fully aware and satisfied that the lion and game species were increasing. I believe, in fact know, that when regularly wardening areas of forest, it is possible to know by sight observations of tracks and animals, whether wild life is increasing or not. Scientific methods of censusing wild life in India have only recently come to light. I for one, prepared 'A Field Guide to Big Game Census in India' in 1958 and since then useful work has been carried out by certain experts.

Although lion shooting took place in and out of the Junagadh Gir, the lion population was still increasing in the thirties, with the result that neighbouring states to Junagadh enjoyed a certain flow of surplus lions, in spite of the Junagadh Nawab's efforts to retain lions within his territory. Often an army of forest guards maintained a ceaseless fire with muzzle loaders to keep lions from straying out where hunters had planned to shoot them.

The lion extended its range, I noticed, from 1931 onwards (from old Bhavnagar and other State records), and by 1938, lions were to be found almost everywhere in the Gir periphery. Soon after Independence, there was a succession of drought years and poaching became indiscriminate and rampant. However, in 1950, a well organized lion census by the Saurashtra State and conducted by a competent naturalist, Wynter-Blyth showed that there were 219 to 224 lions or more in the Gir forests including Girnar (See table 2).

Later in 1955, a similar census was taken by the same authority (excluding the Baroda Gir), which showed a number of 290 lions or a little more. I presume, the population was then at its maximum (See table 3 and Graph).

Table 2**Lion Census held on April 28th and 29th, 1950**

Division	Adult Lions	Young Lions	Totals
Jamwala	39	6	45
Visavadar	19	5	24
Sasan	50	18	68

Table 2—(Contd.)

	Males	Females	Young Lions	Totals
Baroda	19	5	3	27
Jasadhar	23	14	8	45
Mytiala	1	nil	nil	1

Total counted	...	170 adult lions	40 young lions	210
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Girnar	...	3 lions		3
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Hills of Sana	...	6 to 14 lions		6 to 14
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Final total	...	219 to 227		
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Table 3**Census of 1955**

Area	Lions	Lionesses	Young	Total
Sasan Range	52	43	19	114
Visavadar Range	11	9	4	24
Jamwala Range	42	24	14	80
Jasadhar Range	34	22	9	65
Mithiala	...	1	1	2
Girnar	2	1	2	5
Other areas	...	...	...	...
Baroda Gir (not included)				

Totals	141	100	49	290
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(Source: Journal of the Bombay Natural History Society Vol. 53, p. 529)

When I toured the Gir in 1955-56, I found that lion poisoning had already commenced in earnest and that Maldharies were taking control of the lion population, owing to heavy losses to their livestock. When a ban on lion shooting was promulgated by the Bombay Bilingual State, the Maldharies took umbrage at the situation which introduced Lion Shows, for attracting tourists. The Shows created an artificial system of sacrificing buffalo baits to lions, resulting in the lions becoming tame and fearless and attacking domestic livestock freely. The inimical practice of lion poisoning had become rooted.

From an assesment made of the situation, it appears that there was a sudden decline in the lion population from 1956, and by 1963, I feared that the population was nowhere near the 200 mark, and yet, the census figures of that year show 285 lions. However, I continued to notice the lion decreasing from 1964 to 1967 and true enough the census of 1968 revealed 162 to 177 lions. If the 1963 census is correct, a reduction of over 100 lions in 5 years is a drastic slump with no real record of such loss. I find there is always some controversy amidst experts over census figures and methods employed. The Gir area is no doubt a difficult area to census accurately.

All kinds of reasons were given for the fall in lion population, mostly unsubstantiated, from lion cubs being trampled by buffaloes, to devouring by leopards; poisoning of course, being the major cause, which I believe. What I feared was that the Maldharies had wiped out a sizable number of buffalo and cattle-lifting lions in the period from 1955 to 1968. The Eastern Gir, *pari passu*, Jasadhar range to Mitiala was almost depleted of lions, the former holding a good number as seen from the earlier censuses (See tables 2 & 3), whereas, in 1968 the position was reversed (See table 4).

Table 4

Census carried out by Gujarat Forest Department in 1968.*

Range	Males	Females	Cubs	Total
Sasan	7	19	27	53
Visavadar	17	15	15	47
Jamwala	16	13	0	29
Chodavdi	6	3	5	14
Jasadhar	9	6	4	19
Hadala	0	0	0	0
Sarasia-Mitiala	0	0	0	0
Total	55	56	51	162

*Extract from the Indian Forester, Nov. 1969, by M.K. Dalvi IFS., Conservator of Forest, Baroda.

A revisional assessment adds 15 more lions taken from foot-prints in the Hadala and Sarasia-Mitiala Ranges and is as follows:—

Range	Males	Females	Cubs	Total
Hadala	4	5	0	9
Sarasia-Mitiala	1	5	0	6
	5	10	0	15

A Grand Total of 177 lions.

From 1950 onwards the Gir forest was heavily worked and thinned-out to improve forest stands and create areas for plantations and it presented a dreadful sight to those who had seen it earlier. Agricultural intrusions had spread, illicit cutting and poaching had increased. Consequently, by 1969, the Tenth General Assembly of the I.U.C.N. and Natural Resources at its meeting held in New Delhi in November, 1969, aptly passed a resolution on the Asiatic lion requesting India to take steps to recover land under cultivation and to redefine the existing Lion Sanctuary.

With the recent establishment of a Lion Ecological Research Station in the Gir forest and with the resultant research undertaken by it, the Gujarat State has been prompted to make a new Gir Lion Sanctuary Project, within which, a Sanctuary-cum-National Park is to be created solely for the benefit of the lion. It envisages removing the Maldharies with their livestock to the periphery of the forest.

This important Rehabilitation Plan will no doubt enable the lion and its prey and the habitat (Forest Department permitting) to improve and survive external pressures. This five year phased plan which draws the herdsmen out, will probably draw some of the lions with it, but Government has provided compensation for losses sustained by herdsmen, and it is hoped that with strict control over poaching, the Gir ungulates will commence to increase rapidly.

Much of the credit for processing this Project goes to H.E. Shriman Narayan, Governor of Gujarat, and his Adviser, K.T. Sataravala and to the Council of Ecology, and lastly but not least to the Maldharies themselves, who have accepted the Plan.

The present number of over 162 lions appears to be high in comparison with the depleted wild boar and sambar populations. The Axis deer are now more visible owing to thinning of the forest, although the population may have increased as have Langur monkeys, owing to human traffic and environmental changes. The vital need is to create strong control over poaching and illicit cutting of the vegetation both of which pose serious problems, and to stop forest operations except where required.

I may mention that the new Lion Centre created in the Uttar Pradesh State forests has failed, even under the vigilance of the Forest Department.

The Asiatic lion is recognised as a race whose morphological features show prominent tail and elbow tufts and a belly-fringe. The crest mane is not so well developed in the wild. The late E.P. Gee mentions that cubs are not as spotted as those of African lions. It is possible that the belly-fringe is a cause of inadequate food and as a possible fat-reserve like a dew-lap. Some well-fed lions I saw, did not have a belly-fringe.

The Asiatic Lion still remains a threatened species; fortunately however, every effort is being made to preserve the environment and the subspecies. A new deal, for the Indian Lion, our National mammal which is part of the National emblem, is on its way. '*Excelsior, leo persica*'.

It is reported that the Mysore Zoo has procured a pair of sea lions from California in exchange for two baby elephants from the Mysore forests. These sea lions are the first of their kind in any of the Zoos in India and are reported to breed easily in captivity. The Mysore Zoo has a high reputation for success in breeding animals in captivity. We hope that Jaya and Vijaya, as these two sea lions are named, have a happy and fecund conjugal life in the Mysore Zoo.

Occurrence of Genera *Crocidura* and *Talpa* (*Mammalia* : Insectivora) in Central India

By

H. KHUJURIA

Genus *Crocidura*:

The distribution of the genus *Crocidura* in the Indian subcontinent as given by Ellerman and Morrison—Scott (1951) is interesting. The genus occurs in Baluchistan, Kashmir, Punjab, Kumaon, Darjeeling, Bhutan Duars, Assam, Burma, Andaman and Nicobar Islands and Ceylon. One species *C.H. horsfieldi* Tomes occurs in Ladak, Burma and Ceylon. Since the genus has been able to colonize Ceylon, its absence from the main Indian peninsula has remained unexplained. As in the case of other groups, the genus has most likely entered Ceylon from the Indian mainland. It was, therefore, expected that the genus might occur in the main Indian peninsula. This expectation has been justified by the discovery of one skull (without lower jaw) in the pellets of an owl (*Tyto alba* Scopoli). The skull could not be identified upto the specific level. The pellet was collected in the hollow of a tamarind tree (*Tamarindus indica*) near Jabalpur city. The tree is very near a hillock formed by boulders under which several species of small mammals live. However, the form appears to be very rare in the area since an attempt to collect more specimens has failed so far.

Genus *Talpa*:

This genus is represented within the Indian subcontinent by two subspecies of a single species, *T. micrura* Hodgson (*vide* Ellerman and Morrison—Scott, 1951). The species is confined to Nepal, Sikkim, Assam and Burma. A specimen of this genus was seen alive by the author in June, 1969 at a distance of 2½ metres at 10.40 p.m. near the outermost municipal limits of Jabalpur city. It was feeding on winged termites which had gathered around the electric light of the verandah of the author's laboratory. It was observed for about 2 mts. It then entered a hole and could not be followed since the hole was found to have another outlet. The place is surrounded by spacious undeveloped plots of land with a considerable amount of vegetation. The specimen could easily be identified from the characters of its *manus* (with enormous claws), greatly reduced tail and other general external characters which were clearly visible in the light. No specimen could be collected so far, although the Chowkidar on duty during the night in the laboratory having reported seen a similar specimen on a few occasions.

Further search for both these forms is still underway but it has been thought advisable to report these very interesting findings without further delay so that others may also

look for these rare animals which are most likely to be of great taxonomic and zoogeographic interest.

Many Indian species have more or less similar discontinuous distributions. Recently Khajuria (1970) described another such form, a new race of a Himalayan bat (*Hipposideros cineraceus* Peters) from Central India. Elaborate attempts had been made in the past to explain their zoogeographical significance by advancing a number of hypotheses (Audin, 1949; Hora, 1949, 1953, Dilge; 1952). Moore (1960) gave an excellent evaluation of these hypotheses on the basis of his studies on diurnal Indian squirrels.

The author is grateful to Dr. George Topal, Curator of Mammals, Budapest Museum, Hungary and Dr. V.C. Agarwal, Officer-in-Charge, Mammal Section, Zoological Survey of India, Calcutta for confirming the identification of the skull of *Crocidura*.

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Where Flying Vultures Reveal Secrets—Kaziranga

By

DR. ROBIN BANERJEE

The vast region of India has a rich and varied fauna comprising of more than 1000 species of birds, insects, reptiles and fishes, and more than 500 types of animals. In the west, the wild ass of Kutch, the Gir lion, black buck etc., are noteworthy; the water buffalo, rhinoceros, pigmy hog, thamin deer etc., in the east; mountain sheep and goats in the extreme north, while animals like cheetal, sloth bear, gaur, tiger, elephant etc., have wide distribution throughout the country. Many of them are most important economically.

In India we had large numbers of these animals and a rich variety of birds until a few decades ago, but with indiscriminate killing in recent years, a great many have decreased in numbers and some of them have already vanished, for example the Hunting Cheetah.

Why is our wild life vanishing everywhere? In the past, extensive forests provided shelter and protection to wild life and they also provided a good past-time and recreation to the sportsmen who love shooting, just for sport and not for the lust of killing indiscriminately, irrespective of the sex. Even pregnant females were not spared and they were killed at night with spotlights when animals are helpless.

The One-horned Rhino was about to disappear in 1908, but, for the foresight of the then British forest officer, who took steps to protect them in the Kaziranga Wildlife Sanctuary in Assam, which will soon be declared a National Park; and I only hope, not in name only.

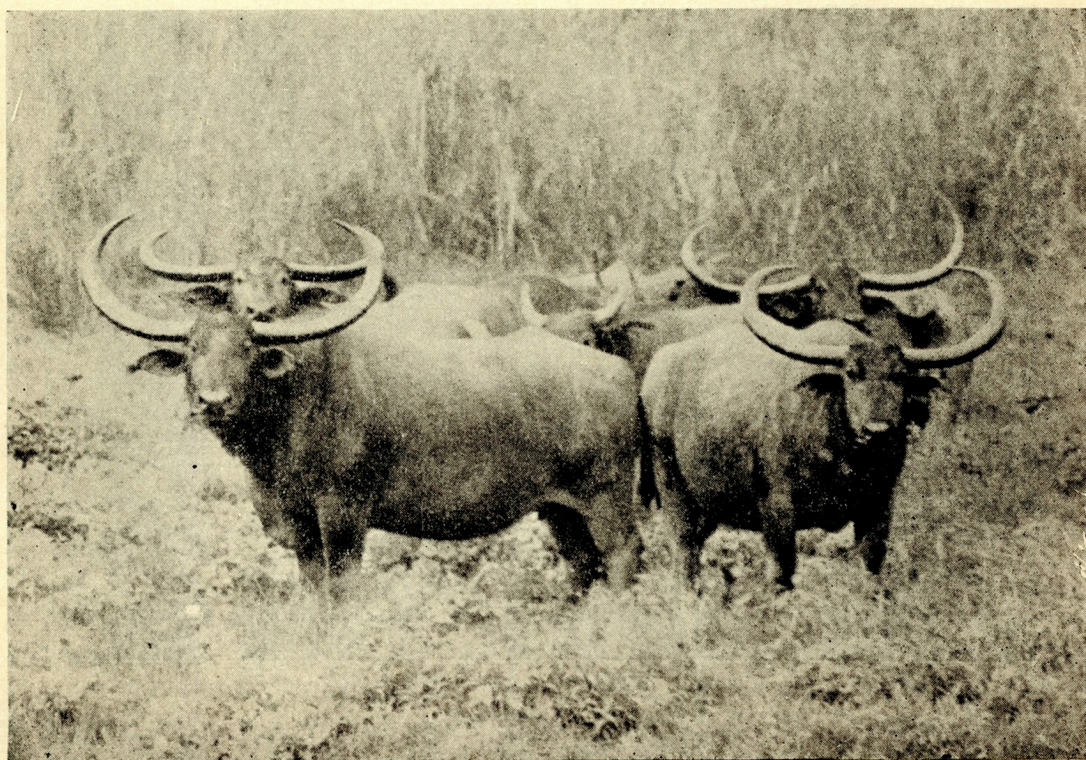
Overhunting, and over-intensive transformation of habitats, have reduced numerous animal populations to the point of extinction. The chief sufferer has been the rhinoceros, which was slaughtered, to satisfy the demands of Chinese pharmacists since the rhinoceros horn is famous for its alleged aphrodisiac properties. High prices (up to half its weight in gold) caused the massacre of this unfortunate animal, and today all Asiatic rhinoceroses are rare.

Indian rhinos (*Rhinoceros unicornis*) have now disappeared from a vast area, stretching from north-western India to the Indo-Chinese peninsula. There are approximately 700 in Nepal, West Bengal and Assam.

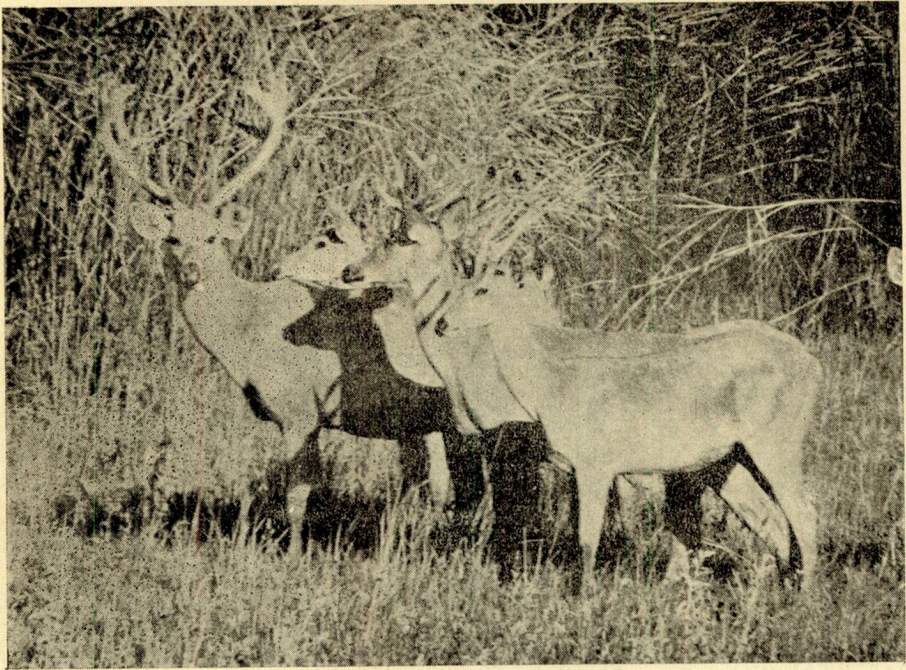
Rhinoceroses are odd toes mammals with three toes. The middle toe is the most highly developed and has the broadest hoof. There is an elastic pad on the sole of the foot, similar to that in elephants. The horn, for which the rhinos are noted, is not made of bone or horn; it is a protuberance of the skin and consists of compressed fur-like fibres. Some species



Mother and baby Rhino in the waterhole.



Wild Buffaloes.



Swamp deer herd.



A rhino pair in Kaziranga.

have two horns: others have only one. Rhinoceroses in the zoos, have been observed shedding their horns in the same way, as stags shed their antlers, but this happens only about once in ten years. The new horn begins to grow again on the scar left by the old.

Rhinoceroses are territorial and remain on the same range throughout their lives. They have fixed trackways through the vegetation, which they use when going to graze, or to watering places. They have also fixed dung places and each beast has its own wallow. This unfortunate habit helps the poachers to kill them by the pit method. The rhino struggles vigorously inside the small, pit and finally breaks its neck. The poachers usually wait for the signal of the flying vultures, then appear at the dead of night to collect the horn only.

Most of the wild animals of India, usually run away from danger and conceal themselves in thick cover but the rhino does the opposite. It continues grazing till danger is rather close, and then, instead of retreating and taking over it exposes itself still more, by charging. This peculiar habit helps the poachers to shoot at close range with country made lead bullets or with high powered rifles fitted with a telescope.

I believe, that an organized intelligent body, either at Calcutta or Bombay usually conducts the poaching for rhinos. They have connections with an international gang, for the final disposal of the horn to the outside market. The local people staying on the border of the Sanctuary, generally act as informers and assist in the poaching.

This is one of the major wildlife problems facing India today. Unless measures are taken to preserve our wildlife it will not be long before it will be lost to us and the generations that follow.

For effective preservation, very strict anti-poaching measure must be taken before it is too late, and I suggest the following:—

- (1) Most important of all, is public awareness of the problems by film shows and propoganda; an informed public is the best safeguard for the integrity of the sanctuary.
- (2) Conservation education in schools and colleges.
- (3) Rifles for patrolling parties and motor boats on the Brahmaputra.
- (4) Elephants for anti-poaching operations in inaccessible areas.
- (5) More forest guards for patrolling specially after the rains (monsoons).
- (6) Funds should be provided to improve the existing roads.
- (7) Walkie-talkies for sending messages from Camp to Kohora (Headquarters).
- (8) Tranquilliser guns for treating injured animals.
- (9) Better patrolling facilities.

On my appeal last year, Dr. Grzimek, Director, Frankfurt Zoological Society, offered money for rifles and elephants. I would also like to mention the name of Prof. Ullrich, Director of Dresden Zoological Society, who offered money for buying elephants. The World Wild Life Fund has given money to buy motor boats for patrolling.

A major shortcoming of the sanctuary is that domestic livestock is permitted to graze within its boundaries. In theory, domestic livestock is allowed to use only a very small part of the Sanctuary; an area of about 3 miles long and one mile deep, but in practice they use much more. A considerable threat to the rhino, and other wild animal species has therefore developed through competition for the limited available fodder, and there is a possibility that disease may spread. Another unfortunate story, is that every year the river Brahmaputra takes away a lot of land through erosion hence it is essential that measures should be taken to exclude all domestic animals from Kaziranga, so that it could become a real sanctuary.

It will not be out of place to mention here, that, the Govetnment of Nepal has set a splendid example to India and other countries, of what can be done with a little drive and determination, to safeguard an endangered species. The Rapti Valley, which was originally the hunting grounds of the powerful Rana family is now a proposed National Park. In 1965 some 22,000 peoples had been removed from these forest including 4,000 from the proposed National Park itself. As a result, poaching has been brought under firm control.

In Assam an increasing number of tourists come every year to see the rhinos in Kaziranga. Strict protection and ample habitat must be assured, if it is to survive from the cruel hands of poachers. The local people should join hands with the management to protect this endangered species. With the assistance being received from the I.U.C.N. and the World Wildlife Fund projects it is a much easier for us to solve the problem of wildlife conservation provided we take the pledge recommended by the Government of India 'I give my solemn pledge to protect our country's wild life and its forests from unnecessary destruction'.

Breeding Birds of Dehra Dun and Adjacent Hills

By

*R.K. BHATNAGAR AND PRADEEP MISHRA

INTRODUCTION

With the improving increased interest in Ornithology and recent realization of economic interests therein, besides mere faunistic, it was felt desirable to bring out a list of breeding birds of Dehra Dun and adjacent hills as this aspect has important bearings on economic ornithology. The object of this article is that naturalists and other workers have at their hands a list easy to refer to and can collect observations systematically.

It is hoped that though incomplete in certain respects, this article would meet the needs of future workers who would make additions wherever necessary.

Sub Class **Neoornithes**
Order **Ciconiiformes**
Family **Ardeidae**

1. *Butorides striatus javanicus* (Horsfield): Little Green Heron
2. *Ardeola grayii* (Sykes): Pond Heron or Paddy Bird
3. *Bubulcus ibis coromandus* (Boddaert): Cattle Egret
4. *Nycticorax nycticorax nycticorax* (Linn.): Night Heron
5. *Xenorhynchus asiaticus asiaticus* (Latham): Blacknecked Stork (Breeding?: Osmaston, 1935)

Order **Falconiformes**
Family **Accipitridae**

6. *Milvus migrans govinda* (Sykes): Pariah or Black Kite
7. *Accipiter badius dussumieri* (Temminck): Shikra
8. *Buteo rufinus rufinus* (Cretschmar): Long-legged Buzzard
9. *Butastur teesa* (Franklin): Whiteeyed Buzzard Eagle
10. *Spizaetus nipalensis nipalensis* (Hodgson): Hodgson's Hawk Eagle
11. *S. (cirrhatus) limnaetus* (Horsfield): Changeable Hawk
12. ? *S. c. cirrhatus* (Gmelin): Crested Hawk Eagle
13. ? *Haliaetus leucoryphus* (Pallas): Fishing Eagle
14. *Torgus calvus* (Scopoli): Pondicherry Vulture
15. *Gyps himalayensis* (Hume): Himalayan Griffon
16. *Gyps bengalensis* (Gmelin): Whitebacked Vulture
17. *Neophron perconopterus ginginianus* (Latham): Scavenger Vulture

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18. *Circaetus gallicus gallicus* (Gmelin): Shorteod Eagle
19. *Spilornis cheela cheela* (Latham): Crested Serpent Eagle

Family **Falconidae**

20. *Falco subbuteo subbuteo* (Linn.): Hobby
22. *F. severus rufipedoides* (Hodgson): Indian Hobby

Order **Galliformes**

Family **Phasianidae**

22. *Alectoris gracca chukar* (Gray): Chukor Partridge
23. *Lerwa lerwa* (Hodgson): Snow Partridge
24. *Francolinus pondicerianus interpositus* (Hartert): Grey Partridge
25. *Coturnix coturnix coturnix* (Linn.): Common Quail
26. *C. coromandelica* (Gmelin): Blackbreasted Rain Quail
27. *Pardicula asiatica punjaubi* (Whistler): Jungle Bush Quail
28. *Arborophila torqueola* (Vallencienes): Hill Partridge
29. *Lophura leucomelana hamiltoni* (Gray): Kaleej Pheasant
30. *Gallus gallus murghi* (Robinson & Kloss): Red Junglefowl
31. *Pavo cristatus* (Linn.): Common Peafowl

Order **Gruiformes**

Family **Turnicidae**

32. *Turnix sylvatica dussumieri* (Temminck): Little Bustard Quail

Family **Rallidae**

33. *Rallina eurizonoides amauroptera* (Jerdon): Banded Crane

Order **Charadriiformes**

Family **Charadriidae**

34. *Vanellus indicus indicus* (Boddaert): Red-wattled Lapwing
35. *V. malabaricus* (Boddaert): Yellow-wattled Lapwing

Family **Rostratulidae**

36. *Rostratula benghalensis benghalensis* (Linn.): Painted Snipe

Family **Burhinidae**

37. *Burhinus oedicephalus indicus* (Salvadori): Stone Curlew

Family **Galereolidae**

38. *Glareola lactea* (Temminck): Small Pratincole

Order **Columbiformes**Family **Columbidae**

39. *Columba leuconata leuconata* (Vigors): Himalayan Snow Pigeon
40. *C. livea intermedia* (Strickland): Blue Rock Pigeon
41. *Streptopelia orientalis meena* (Sykes): Rufous Turtle Dove
42. *S. decaocto decaocto* (Frivaldzky): Ring Dove
43. *S. t. tranquebarica* (Hermann): Red Turtle Dove
44. *S. chinensis suratensis* (Gmelin): Spotted Dove
45. *S. senegalensis cambayensis* (Gmelin): Little Brown Dove
46. *Chalcophaps indica indica* (Linn.): Emerald Dove

Order **Psittaciformes**Family **Psittacidae**

47. *Psittacula krameri borealis* (Neuman): Rose-ringed Parakeet
48. *P. cyanocephala bengalensis* (Forster): Blossom-headed Parakeet
49. *P. himalayana himalayana* (Lesson): Himalayan Slatyheaded Parakeet

Order **Cuculiformes**Family **Cuculidae**

50. *Clamator jacobinus* (Boddaert): Pied Crested Cuckoo
51. *Cuculus canorus canorus* (Linn.): The Cuckoo
52. *Cacomantis sonneratii sonneratii* (Latham): Banded Bay Cuckoo
53. *Centropus sinensis sinensis* (Stephens): Crow Pheasant
54. *C. toulou bengalensis* (Gmelin): Lesser Coucal

Order **Strigiformes**Family **Strigidae**

55. *Otus scops sunia* (Hodgson): North Indian Scops Owl
56. *Bubo bubo bengalensis* (Franklin): Eagle Owl or Great Horned Owl
57. *Glaucidium brodiei brodiei* (Burton): Collared Pygmy Owlet
58. *G. radiatum radiatum* (Tickell): Barred Jungle Owlet
59. ? *G. cuculoides cuculoides* (Vigors): Himalayan Barred Owlet

Order **Caprimulgiformes**Family **Caprimulgidae**

60. *Caprimulgus macrurus albonotatus* (Tickell): Long Tailed Nightjar
61. *Caprimulgus asiaticus asiaticus* (Latham): Little Nightjar or Common Indian Nightjar
62. *C. affinis monticollis* (Franklin): Franklin's Nightjar

Order **Apodiformes**Family **Apodidae**

63. *Apus affinis affinis* (J.E. Gray): Common Indian House Swift
 64. *Hemiprocne longipennis coronata* (Tickell): Crested Tree Swift

Order **Coraciiformes**Family **Alcedinidae**

65. *Ceryle lugubris guttulata* (Stejneger): The Himalayan Pied Kingfisher
 66. *Alcedo atthis* (Linn.): Common Kingfisher
 67. *Halcyon smyrensis smyrensis* (Linn.): Whitebreasted Kingfisher

Family **Meropidae**

68. *Merops orientalis orientalis* Latham: Common Green Bee-eater

Family **Coraciidae**

69. *Coracias benghalensis benghalensis* (Linn.): Roller or Blue Jay

Family **Upupidae**

70. *Upupa epops epops* (Linn.): Hoopoe

Family **Bucerotidae**

71. *Tockus birostris* (Scopoli): Common Grey Hornbill

Order **Piciformes**Family **Picidae**

72. *Picus xanthopygaeus* (J.E. & H.R. Gray): Little Scalybellied Green Woodpecker
 73. *Dinopium benghalense* (Linn.): Lesser Goldenbacked Woodpecker
 74. *Dendrocopos nanus nanus* (Vigors): Himalayan Pygmy Woodpecker

Order **Passeriformes**Family **Eurylaimidae**

75. *Psarisomus dalhousiae dalhousiae* (Jameson): Longtailed Broadbill
 76. *Eremopterix grisea* (Scopoli): Ashycrowned Finch-Lark
 77. *Alauda gulgula* Franklin: Eastern Skylark or The Small Indian Skylark

Family **Hirundinidae**

78. *Riparia plaudicola chinensis* (J.E. Gray): Plain Sand Martin
 79. *Hirundo concolor* (Sykes): Dusky Crag Martin

- 80. *H. smithii* (Leach): The Wiretailed Swallow
- 81. *H. rustica rustica* (Linn.): The Common Swallow
- 82. *H. fluvicola* (Blyth): Indian Cliff Swallow
- 83. *Delichon urbica cashmiriensis* (Gould): House Martin

Family **Laniidae**

- 84. *Lanius excubitor lahtora* (Sykes): Indian Grey Shrike
- 85. *L. tephronotus tephronotus* (Vigors): Greybacked Tibetan Shrike
- 86. *L. schach erythronotus* (Vigors): Rufousbacked Shrike

Family **Oriolidae**

- 87. *Oriolus oriolus kundoo* (Sykes): Indian Oriole or Golden Oriole
- 88. *Dicrurus adsimilis macrocerus* (Vieillot): Black Drongo

Family **Artamidae**

Family **Sturnidae**

- 89. *Sturnus pagodarum* (Gmelin): Blackheaded or Brahminy Myna
- 90. *S. contra contra* (Linn.): Pied Myna
- 91. *Acridotheres tristis tristis* (Linn.): Common Myna
- 92. *A. ginginianus* (Latham): Bank Myna
- 93. *A. fuscus fuscus* (Wagler): Jungle Myna

Family **Corvidae**

- 94. *Garrulus lanceolatus* Vigors: Blackthroated Jay
- 95. *Kaitta erythoryncha occipitalis* (Blyth): Redbilled Blue Magpie
- 96. *Dendrocitta vagabunda pallida* (Blyth): Indian Tree Pie
- 97. *D. v. vagabunda* (Latham): Indian Tree Pie
- 98. *D. formosae occidentalis* (Ticehurst): Himalayan Tree Pie
- 99. *Nucifraga caryocatactes multipuncta* (Gould): Larger Spotted Nutcracker
- 100. *Pyrrhocorax graculus digitatus* (Hemprich & Ehrenberg): Yellowbilled Alpine Chough
- 101. *Corvus splendens splendens* (Vieillot): House Crow
- 102. *C. macrorhynchus intermedius* (Adams): Jungle Crow

Family **Campephagidae**

- 103. *Pericrocotus flammeus speciosus* (Latham): Scarlet Minivet
- 104. *P. brevirostris brevirostris* (Vigors): Shortbilled Minivet
- 105. *Aegithina tiphia tiphia* (Linn.): Common Iora
- 106. *Chloropsis aurifrons aurifrons* (Temminck): Goldfronted Cholropsis

107. *Pycnonotus leucogenys* (Gray): Whitecheeked Bulbul
 108. *P. cafer intermedius* Blyth: Redvented Bulbul

Family **Muscicapidae**

109. *Pellorneum ruficeps punctatum* (Gould): Spotted Babbler
 110. *Pomatorhinus schisticeps leucogaster* (Gould): Slatyheaded Scimitar Babbler
 111. *P. erithrogenys erithrogenys* (Vigors): Rustycheeked Scimitar Babbler
 112. *Chrysomma sinensis hypoleuca* (Franklin): Yelloweyed Babbler
 113. *Turdoides caudatus caudatus* (Dummont): Common Babbler
 114. *T. striatus* (Dummont): Jungle Babbler
 115. *Garrulax albogularis whisteleri* (Baker): Whitethroated Laughing Thrush
 116. *G. striatus striatus* (Vigors): Striated Laughing Thrush
 117. *G. leucolophus leucolophus* (Hardwicke): Him. Whitecrested Laughing Thrush
 118. *G. rufogularis occidentalis* (Hartert): Rufouschinned Lau. Thrush
 119. *Leiothrix lutea kumainensis* (Whistler). Redbilled Leiothrix
 120. *Ptheruthius xanthochloris occidentalis* (Harington): Green Shrike Babbler
 121. *Minla strigula simlaensis* (Meinertzhagen): Stripethroated Chestnut Minla
 122. *Muscicapa superciliaris superciliaris* (Jerdon): Whitebrowed Flycatcher
 123. *M. rubeculoides rubeculoides* (Vigors): Bluethroated Flycatcher
 124. *Rhiphidura hypoxantha* (Blyth): Yellowbellied Fantail Flycatcher
 125. *R. albicollis canescens* (Koelz): Whitethroated Fantail Flycatcher
 126. *Cettia pallidipes pallidipes* (Blanford): Pale footed Bush Warbler
 127. *Prinia gracilis lepida* (Blyth): Streaked Longtailed Warbler
 128. *P. socialis stewarti* (Blyth): Ashy Longtailed Warbler
 129. *P. sylvatica gangetica* (Blyth): Jungle Longtailed Warbler
 130. *Orthotomus sutorius guzurata* (Latham): Tailor Bird
 131. *Phylloscopus affinis* (Tickell): Yellow bellied Willow Warbler
 132. *P. proregulus simlaensis* (Ticehurst): Yellow rumped Leaf Warbler
 133. *Erithacus cyanurus pallidior* (Baker): Orange-flanked Bush Robin
 134. *E. chysaecus whisteleri* (Ticehurst): Golden Bush Robin
 135. *Copsychus saularis saularis* (Linn.): Magpie Robin
 136. *C. malabaricus indicus* (Baker): Shama
 137. *Phoenicurus frontalis* (Vigors): Bluefronted Redstart
 138. *Cercomela fusca* (Blyth): Brown Rock Chat
 139. *Chaimarrornis leucocephalus* (Vigors): Whitecapped Red Start
 140. *Myiophoenius caeruleus temminckii* (Vigors): Blue Whistling Thrush
 141. *Zoothera dauma dauma* (Latham): Smallbilled Mountain Thrush
 142. *Turdus ruficollis atrogularis* (Jarocki): Redthroated Thrush

Family **Paridae**

143. *Parus dichrous kangrae* (Whistleri): Brown Crested Tit
 144. *Aegithalos concinnus iradalei* (Baker): Redheaded Tit

Family **Motacillidae**

145. *Anthus hodgsoni hodgsoni* (Richmond): Hodgson's Tree Pipit
 146. *A. novaeseelandiae rufulus* (Vieillot): Paddyfield Pipit
 147. *Motacilla maderaspatensis* (Gmelin): Large Pied Wagtail

Family **Nectarinidae**

148. *Nectarina asiatica* (Latham): Purple Sunbird
 149. *Aethopyga siparaja seheriae* (Tickell): Yellow Sunbird
 150. *Zosterops palpebrosa* (Temminck): Indian White-eye

Family **Ploceidae**

151. *Passer domesticus indicus* (Jardine & Selby): House Sparrow
 152. *Ploceus philippinus philippinus* (Linn.): Weaver Bird
 153. *P. benghalensis* (Linn.): Blackthroated Weaver Bird
 154. *Estrilda amandava amandava* (Linn.): Red Munia
 155. *Lonchura malabarica malabarica* (Linn.): Whitethroated Munia
 156. *L. punctulata punctulata* (Linn.) Spotted Munia

Family **Fringillidae**

157. *Mycerobas icteroides* (Vigors): Black or Yellow Grossbeak
 158. *Carduelis carduelis caniceps* (Vigors): Gold Finch
 159. *C. spinoides spinoides* (Vigors): Himalayan Green Finch
 160. *Emberiza cia par* (Hartert): Rock Bunting
 161. *Melophus lathamii subcristatus* (Sykes): Crested Bunting

Broad groupings of Breeding Birds:

To facilitate groupwise listing, given below are the serial numbers of the species (as in this publication) hyphen serial numbers of the species as in Synopsis Pts. I, II & III (Bhatnagar & Misra, 1971, 1972—a & b). Serial numbers marked with sign of interrogation are those whose breeding within the area is doubtful.

a. Breeding Birds of Plains (valley):

1-9; 3-11; 4-15; 5-19; 7-43, 14-59; 15-62; 16-63; 17-64; 19-71; 24-84; 25-85; 26-86; 27-88; 31-97; 32-98; 33-101; 34-108; 35-110; 36-126; 37-127; 38-129; 40-135; 41-138; 42-139; 43-140; 44-141; 45-142; 46-143; 47-146; 48-147; 50-151; 51-155; 53-163; 54-164; 55-165; 56-170; 57-171; 58-172; 59-173; 60-177; 61-178; 62-179; 63-182; 64-183; 66-186; 67-188; 68-190; 69-192;

70-193; 77-194; 72-203; 73-207; 74-212; 77-222; 78-223; 79-224; 80-225; 81-3-225-30; 84-231; 85-233; 86-234; 87-235; 88-238; 89-245; 90-247; 91-248; 92-249; 93-250; 96-255; 97-256; 101-261; 102-262; 105-271; 106-272; 107-257; 108-276; 110-282; 112-287; 113-288; 114-290; 118-295; 146-456; 147-466; 148-470; 149-474; 150-477; 151-479; 152-484; 154-487; 155-488; 156-490.

b. **Breeding Birds of Plains & Lower Hills:**

6-39; 7-43; 15-62; 16-63; 17-64; 19-71; 24-84; 25-85; 27-88; 31-97; 32-98; 34-108. 35-110; 37-127; 40-135; 46-143; 47-146; 48-147; 51-155; 53-163; 54-164; 55-165; 56-170; 57-171; 58-172; 59-173; 60-177; 61-178; 62-179; 63-182; 64-183; 66-186; 67-188; 69-192; 71-194; 72-203; 73-207; 74-212; 76-219; 77-222; 78-223; 80-225; 84-231; 85-233; 86-234; 87-235; 91-248; 96-255; 97-256; 102-262; 107-275; 109-280; 110-282; 112-287; 114-290; 147-466; 148-470; 149-474; 150-477; 151-479; 152-484; 153-486; 154-487; 155-488; 156-490.

c. **Breeding Birds of Lower Hills:**

2-10; 6-39; 4-43; 9-47; 15-62; 16-63; 17-64; 19-71; 22-81; 24-84; 25-85; 27-88; 28-89; 29-93; 30-94; 31-97; 32-98; 34-108; 35-110; 37-127; 40-135; 46-143; 47-146; 48-147; 49-149; 51-155; 53-163; 54-164; 55-165; 56-170; 57-171; 58-172; 59-173; 60-177; 61-178; 62-179; 63-182; 64-183; 65-184; 66-186; 67-188; 69-192; 71-194; 72-203; 73-207; 74-212; 75-214; 76-219; 77-222; 78-223; 80-225; 84-231; 85-233; 86-234; 87-235; 91-248; 94-252; 25-254; 96-255; 97-256; 98-257; 102-262; 107-275; 109-280; 110-282; 112-287; 114-290; 119-300; 125-323; 126-328; 127-339; 128-342; 129-343; 130-345; 135-381; 136-382; 138-398; 147-466; 148-470; 149-474; 150-477; 151-479; 152-484; 153-486; 154-487; 155-488; 156-490; 156-490; 161-527.

d. **Breeding Birds of Higher Hills:**

8-46; 10-48; 11-49; 12-50; 23-83; 30-94; 39-134; 94-252; 95-254; 97-256; 98-257; 99-258; 100-259; 111-283; 166-292; 117-293; 120-303; 121-304; 122-314; 123-317; 124-321; 131-353; 132-360; 134-379; 137-386; 139-405; 140-410; 141-415; 142-422; 143-439; 144-443; 145-453; 157-493; 158-497; 159-498; 161-527.

Acknowledgments

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Summary

This article brings out the first comprehensive record of breeding birds of Dehra Dun and adjacent hills. A total 161 breeding birds of the area are recorded. Of these, 95-breed

in the plains or valleys, 65-breed in plains or valley and lower hills (Siwaliks and Himalayan foot-hills), 88-breed in lower hills and 36-are breeding birds of the higher hills (referred to alt.: 8,000 and above). These groupwise numbers include those which breed at more than one elevation.

Further details on this aspect shall follow in another publication.

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2. (1972) — Revised Synopsis of Birds of Dehra Dun and adjacent Hills. Pt.-II (*Columbiformes* to *Piciformes*). *Cheetal Journal of the Wild Life Preservation Society of India*.
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NOTE

The following have also been observed breeding in Dehra Dun:—

Order—**Strigiformes**

Family—**Strigidae**

- (1) *Otus bakkamoena* (Pennant): Collared Scops Owl.

Order—**Coraciiformes**

Family—**Meropidae**

- (1) *Merops philippinus* (Linn.): The Bluetailed Bee-eater.

- (2) *Merops leschenaulti* (Vieillot): Chestnut-headed Bee-eater.

Family—**Coraciidae**

- (1) *Eurystomus orientalis* (Linn.): Broadbilled Roller or Dollar bird.

Order—**Piciformes**

Family—**Picidae**

- (1) *Dendrocopos mahrattensis* (Latham): Yellowfronted Pied Woodpecker.

- (2) *Micropternus brachyurus* (Vieillot): Rufous Woodpecker.

Distribution, Composition and Herd Size of Gaur (*Bos gaurus*) in Palamau, Bihar

By

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Palamau district was once remarkable for its variety of large mammals, a richness in species exceeded by few districts in Bihar. This district is endowed with forest growth varying in composition. The northern and western parts are now almost denuded, but the eastern and southern parts have good vegetation growth containing dry deciduous mixed forests, to moist deciduous mixed forests with bamboo (*Dendrocalamus strictus*) as the predominant undergrowth in both the types. There are some patches of pure sal (*Shorea robusta*) forests but its usual associates are almost absent in these areas. Palamau presents a great diversity of local vegetational types with its unique faunal assemblage. Sal and bamboo forests are the home of elephants, though local migration, depending upon the seasonal variations, does occur. The gaur (*Bos gaurus*) prefers this type but remains in these areas even during extreme weather conditions. The cheetal, sambhar, barking deer, and nilgai are distributed over the entire forest area of the district. The black buck, Indian gazelle and four-horned antelope are now almost extinct from the district. Tigers and leopards are still holding on, even in the worst areas. The wild boars are in larger numbers and inhabit almost every forest area. Sloth bears are choosy and prefer to remain confined to the hilly area. Hyenas and wolves are not too many and are distributed over a large area of the district. It is good that wild dogs, though in small numbers, are not confined to a particular area.

Habitat of Gaur

The gaur is one species which is confined to few choice areas only. Their number would have gone down alarmingly but for the protection recently afforded to them; the main cause being deterioration of its habitat, poaching in the past, predation by tigers and susceptibility to the diseases prevalent among local cattle, chiefly Rinderpest and Foot and Mouth.

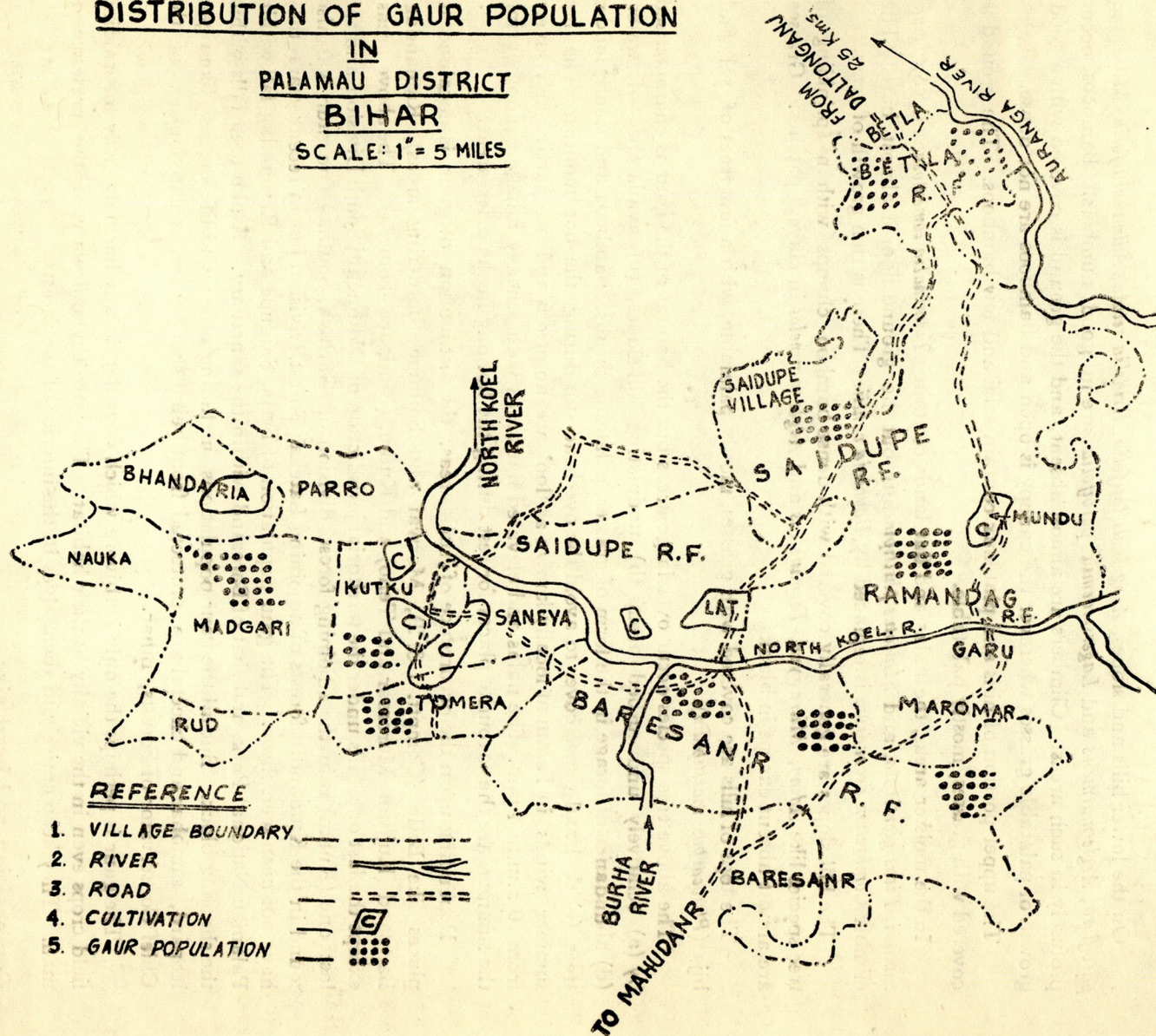
As mentioned earlier, the composition of the forest growth is very variable. The following distinct zone within a small area can be recognised. In the dry mixed deciduous forests, the moister areas along the nala and flat lands contain *Terminalia tomentosa*, *Ficus religiosa*, *Ficus glomerata*, *Bridelia retusa* and *Holoptelia integrifolia*. The canopies of several trees are covered with the climber *Combretum decandrum* which results in a closed canopy. The undergrowth consists of shrubby *Mallotus philippinensis*. Grasses are almost absent.

DISTRIBUTION OF GAUR POPULATION

IN
PALAMAU DISTRICT
BIHAR

SCALE: 1" = 5 MILES

DISTRIBUTION, COMPOSITION AND HERD SIZE OF GAUR (*Bos gaurus*) IN PALAMAU



On the lower hills and slopes, *Anogeissus latifolia*, *Bridelia retusa*, *Adina cordifolia*, *Mitragyna parviflora*, *Aegle marmelos* and *Lagerstroemia parvifolia* are in good numbers. Bamboos occur profusely in such areas. Climbers are almost absent and the ground is covered with a good growth of palatable grasses wherever the canopy is open and bamboos are not dense.

The upper portion of hills and plateaux contain salai and few bamboos. The ground is covered with grasses, mostly palatable.

In the moister areas, the nalas and flat lands contain *Terminalia tomentosa*, sal, *Syzigium cumini*, *Ficus glomerata*, and *Mallotus philippinensis*, but the ground floor is almost bare. The climber *Combretum decandrum* is replaced by *Bauhinia vahlii*. There is rich growth of grass.

The hill slopes are generally covered with dense bamboo clumps with a sprinkling of tree species like *Adina*, *Mitragyna*, *Terminalias* and *Aegle marmelos* in clayey patches. Grasses are almost absent except in blanks.

The tops of hills are covered with grasses, mostly palatable, with a few trees of sal and bija (*Pterocarpus marsupium*).

The above tree species occur over large areas but the habitat of the gaur is characterised by (a) relatively undisturbed area, (b) undulating hill slopes, (c) availability of water, (d) abundance of forage in the form of grasses, palatable shrubs, bamboos and small fodder trees, (e) cool and dense cover to avoid the overhead sun during the hot months. The hot summer winds in Palamau locally known as 'loo' are notorious and are particularly severe from 10 a.m. to 4 p.m. The nalas and elevated flat lands with a heavy foliage canopy during the summer, are the favourite places for rest during the hot day in the drier areas.

Depending upon the occurrence of such areas, the distribution of gaur is localised to places like Betla (Comptt. 1 & 2), Morwai and Saidupe (bordering areas), Ramandag, Baresand (Kujrum, Maromar and Teno) and Kutku, (Madgari, Tomera). The above areas, except the last one, falls under the territorial jurisdiction of Daltonganj South Division and the last one (Kutku) is in the adjoining forest division of Garhwa, South. The gaur was also found in the Kumandih forests of adjoining Latehar Forest Division but in recent years they have not been seen there. The gaur population of Betla, Saidupe and Ramandag fall within Palamau National Park, and that of Baresand within the sanctuary. Kutku area falls within the shooling block. But all the gaur populations, including other wild life species like tiger, leopard, sambhar and cheetal are protected from being shot by the executive orders of the Chief Conservator of Forests, Bihar.

The gaur is perhaps the only herbivore which does not do any harm by way of raiding field crops even in the vicinity of their habitat. They are shy and wary of the presence of man. They keep entirely to themselves in the interior of the forests.

Composition and herd size

Before the composition of gaur herds is dealt with, it is felt necessary to deal briefly with the daily activities of this species. The gaur is an animal essentially of denser wood-lands.

It comes into the open only when such areas are calm and quiet. Most of the activities of the gaur are at night and by the day-break they start moving back into cover, inside the forest. In Palamau National Park they are rarely seen during the day in the open grassy patch, though they have been seen inside the forest, a few hundred yards away from this area. During the daytime, after 10 a.m., they generally rest even under light shade far, not away from a water hole. The resting ground is generally an elevated flat area from where they can command a view of large areas. This situation is more important to a herd consisting of small calves. Herds with calves could never be located in the dense, cool and shady valleys. The black bulls when not in herds, rest in shady and cool places, obviously in the valleys. A herd generally grazes or browses in a casual manner while on the move during the day. They feed for almost 12 to 15 hours a day. They are bulky animals and require large quantities of food. They prefer the early morning and evening hours for grazing and browsing. They drink water at least twice in twenty four hours and there appears to be no fixed time for this purpose. It depends largely upon the requirement of individual animals, but when water is limited, small herds, at times, coalesce to form a larger herd before approaching the water-hole. After drinking water, the herds again disintegrate, generally during the morning and evening hours, for grazing. Thus the availability of food, shelter and water have a direct bearing on the form of herds, besides other things.

There seems to be no definite pattern of large herds being formed among gaur. This is largely a matter of convenience and timing of individuals meeting or of small herds coming together accidentally. While grazing or browsing, they remain scattered over an area of about a hectare depending on the herd size. Whenever there are black bulls accompanying the herd, they are generally at the rear of the herd. A cow gaur generally leads the herd; sometimes the brown bull may also take up the leadership. Herd formation also depends on the total number of the species present in a locality. In Palamau, gaur are isolated in small numbers at different places. Even at Betla the population of one compartment rarely meets the population of an adjoining compartment though their centres of activity are hardly four kilometres apart. At times they have been seen to drink water from the same water-hole (Baigapani water hole) after which they return to their own respective areas. This is also true for gaur in other areas of the district.

The smallest number of individuals seen in a herd was two, whereas the maximum number was 27 out of a total population of about thirty-five, except for the stray black bulls. Black bulls were observed to be alone at many times. The small groups of 2 were also of black bulls moving together on different occasions. Otherwise, the smaller herds consist of a family—mother, yearling cow or bull, small calf and sometimes a brown bull. Mothers with calves were seldom seen moving alone.

Brown bulls are usually attached to the herd and are often members of the same family. They were not seen alone or with companions, away from the herd.

The following table shows seasonal variations in herd size and percentage of herds containing brown bulls.

Seasons	No. of herds seen	No. of individuals seen	Av. herd size	Percentage of herds containing brown bull	Remarks
Winter (Nov.-F b.)	26	124	4.7	84	Lone bulls are not included in the herd.
Summer (March-June)	31	249	8.0	93	
Rains (July-Oct.)	19	65	3.4	89	

The above tabular statement shows that there is tendency to form large herds during the summer. Smaller herds are observed during the rains. Visibility during the summer is good while predation by tigers on the smaller calves, the limited water holes and the limited forage area, force them to form large herds. The forage and water conditions improve during the rains, and the herds scatter.

Herds averaged 5 to 7 individuals. Schaller (1967) noted at Kanha that the average herd contained 8 to 11 individuals, Inverarity (1889) 12 to 20 animals, Brander (1923) 8 to 12, Russell (1900) 10 to 20 and Sanderson (1912) about 12. In Burma, herds average 10 to 20 animals with as many as 50 together on occasions (Pocock 1933). Almost every author has given a flexible figure. Except in the case of Kanha, no indication is available about the size of the population. In the earlier periods, may be there were large populations. All these figures are higher than the figure obtained by me in Palamau National Park. The reason is obviously the presence of the localised population consisting of smaller numbers at different places, though the area is almost contiguous. The herds have remained localised and do not mix with each other.

Composition of the population for the whole year was 0.60 black bulls, 0.70 brown bulls, 2.2 cows, 0.90 yearling bulls and cows, and 1.70 calves. An analysis of the above figures in respective size classes, shows that 22 cows were accompanied by 17 calves. The calves include large, medium and small calves, as classified by Schaller (1967). This implies that either mortality occurred to 5 calves or about 23% of the cows did not give birth as these may have been sterile or had aborted after pregnancy. Again, out of 17 calves only 9 survived to pass to the yearling class. Thus the mortality from calves to yearlings is almost 47%.

A larger number of small calves were seen from February to April, when the availability and quality of milk is also reduced. This, and the predation on the calves by tigers, is the main cause of such a high mortality rate, though mothers appear take adequate precaution against predation and do not leave the herd when with calf. However, the condition is better than that in Kanha National Park where 47 cows gave birth to 23 calves i.e. 30% cows were either sterile or aborted. Again, out of 23 calves, 12 or 52% passed to yearling class. This is comparable to my figure of 53% passing to the yearling class. However, as against a higher rate of mortality among brown bulls in Kanha, only 50% passing on to black bulls, the rate of mortality in Palamau is very low—only about 14%. The daily movement of the gaur is limited in area to about 20 sq. kms. in a year. Most of the animals remain confined to a particular area for about a week and then move to an adjacent area.

Table showing cow-calf ratio

Season	No. of herds observed (excluding lone bulls)	No. of herds containing cows without calf	Percentage of herd containing cows without calf
Winter (Nov.-Feb.)	26	22	85
Summer (March-June)	31	21	69
Rains (July-Oct.)	19	17	89

When the herd moves, every member of the herd moves because the same herd composition was observed at different places. It is also very interesting to note that cows without calves do not form separate herds, but remain attached to the herd of cows with calves, in most of the cases. During the rut a cow and a black bull or a brown bull separate from the herd but do not move far away. When mating is over the cow re-joins the herd.

During the summer, cows without calf were seen moving with the black bulls for few days not far from the herd to which the cow belonged. The black bull wanders about a great deal during this period in search of cows in heat. Attempts to mount were observed during this period only.

As stated earlier, the composition of herd varied. There were very few occasions when only brown bulls and yearling bulls were seen. Occasionally the brown bulls and yearlings

accompanied the herd; however, the number of bulls in a herd changed with the time and season of the year. A larger number of bulls were noticed accompanying a herd with the onset of the rutting season—though not very well defined but usually in spring, when the cow gaur is in heat. She is generally possessed by a strong black bull which by sheer strength drives away other bulls. The two (black bull and cow in heat) remain together for not more than a week. During the summer a larger number of bulls with injuries can be seen, specially with scratches on the body, limping and with wounds caused by horns. Brown bulls, though larger in numbers than black bulls, prefer to remain with the herd and only on rare occasions are seen alone. Solitary black bulls have been located for five days in small areas and then seen about 2 kms. away. Solitary bulls wander more than those with the herd. A black bull was seen at two different places, 5 kms apart on successive days. During the rut the bull does not leave the company of the cow in heat for about 5 days. The cow at this time isolates herself from the rest of the herd and remains with the bull. During the rains and winter, smaller herds are seen scattered for longer periods and during summer, large herds are seen together. This is perhaps for protection against predation. Mortality among calves increases during the early rains as fewer calves (large and medium size) are seen with the herds afterwards.

Acknowledgement

The author is greatly indebted to the Chief Conservator of Forests, Bihar for encouraging him to take up this study, offering photographs and rendering his valuable advice from time to time. Thanks are due to Shri S.R. Chowdhury, S.R.O., Wildlife Education, F.R.I. and Colleges, Dehra Dun for critically going through the manuscript and for the useful suggestions.

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Tiger Census in India

(SUMMER 1972)

By

SAROJ RAJ CHOUDHURY

PART I

The Need for a Tiger Census

The tiger population in India has been steadily decreasing during the last two decades. This is apparent from the increasing rarity of the signs and symptoms in the forest that indicate the presence of a tiger.

There were in the recent past, many tigers in this country, but not 40,000 as claimed by some. That it could not be 40,000 would be evident to any one who would take the trouble to work out the biotic pyramid that sustains a tiger along with its competitors—the panther, the wild dog, the human being and the sneaking lesser carnivores—and the consequent useable land surface available in its habitat to produce the surplus in prey animals required to sustain the tiger during each animal year. And again, what would be the productivity of such a high population with its equally high biotic potential, an average of two to three cubs per litter, and the tigress with different age-grouped cubs at heel. 40,000 does not stand patient reasoning.

That there were many more tigers then than there are now is however true. This is evident from the high frequency and density of tiger-evidences that were seen in those days and their sporadic occurrence to-day. Such signs are indeed rare now, in some of the best tiger areas of yester years, the Chandaka Sanctuary in Orissa for example. There are equally other good areas—the Phubani district of my own State, Orissa, with 46 tigers in the 1966 census and 8 tigers in the present census—where tigers have perhaps been reduced to just lone stragglers,—I earnestly hope not. And yet, there remain a few areas—some of the Siwalik forests in U.P. for example—where the tiger virtually lives in saturation density. But on the whole, the population-trend in the country has been on the decline.

The main reasons for this decline are, indiscriminate killing of its prey animals and poaching of tigers for their highly priced pelts. The destruction of shelters—particularly for the cubs—due to indiscriminate human use of the tiger habitats has also contributed to its decline.

The greatest of all tiger-men, Jim Corbett, who is honoured even to-day as a demi-god in many parts of the Kumaon hills, stated three decades ago in the Author's Note to his *Man-eaters of Kumaon* "there is, however, one point on which I am convinced that all sportsmen will agree with me, and that is, that a tiger is a large-hearted gentleman with boundless courage and when he is exterminated—as *exterminated he will be unless public opinion rallies to his support*—India will be poorer by having lost the finest of her fauna." Corbett's apprehension appears to be taking concrete shape. If it does happen, it will certainly be very unfortunate for this country. But I am confident, we will not allow it to happen. Even with our growing problems of human population and the resultant increase in the material and social conflicts, we will continue to strive earnestly to locate areas to save the tiger where it can be saved and manage it the way it needs to be managed for posterity.

In order to be able to save and manage the tiger we must organise our approach methodically. In this, the important first step is to collect confident objective data about its past and the present status. It will only then be possible to plan its future. The approach involves four leading questions.

1. Where is the tiger?—Locate it as confidently as is practicable.
2. How is the tiger?—Evaluate its habitat factors and influences.
3. If it has vanished from any of its habitats, why has it vanished?—Collect reliable historical facts that focus on the factors and influences that led to its disappearance.
4. What is its future?—Project the values from questions No. 1 and 2 in the context of evidences from question 3.

The future of the tiger depends basically on the level of confidence in the answer to the first question, "Where is the tiger?" All other considerations and actions will follow only when we know the distribution and densities of the living tigers in our forests to-day. We must then, first locate and count them.

The method of tiger census

The wild tiger is an elusive animal. It has to be drawn by baits to particular spots for sophisticated tiger shooting. Of the 100 odd forest officers and honorary wild life wardens who were trained by me in tiger census methods, many had not seen the tiger in its natural state and others only occasionally during their long association with the tiger habitat. The tiger cannot be censused by sighting. Even if seen, it is difficult to remember each tiger individually without repeated clear and long duration sighting, so as to identify and differentiate specific physiognomic and other external characters of each individual animal.

Champion's method of automatic trip-photography—simple, single shot or sophisticated repeater shots—can be used to freeze on the celluloid, the details of each tiger and analyse the results from a large number of such gadgets set at every likely place of success in the

tiger habitats. This can be done in specific in-depth study areas only, but cannot be used as a census method for the whole country; the cost would be prohibitive.

Counting the tigers by artificially inducted kill-evidences—like the lion census in the Gir in 1968—is much of theory and more of expenditure without yielding reliable results.

The only practical method of counting tigers is first to learn to recognise the signs and symptoms of the tiger in the field, age them and interpret their meanings. The next step is to put many trained persons in the field simultaneously, each to collect in a small unit, the tiger-evidences in relation to space and time, and thus cover the total area of counting within a specified period. If all the participants follow a regimented pattern of methodology in the spatio-temporal recording of the signs and symptoms of tigers in the field, the integrated data can be compared and analysed to eliminate double counting in adjacent or over-lapping territories, and estimate as accurately as possible whether there are one or more tigers in the same territory. The outcome of such an integrated analysis is the estimate of the total tiger population in any particular region of contiguous forests. The tiger habitats in this country, however, spread not only across district boundaries but are also inter-states. Evidently, the counting in such areas has to be done together and co-ordinated in the concerned states.

This basic structure of the tiger census operation has been termed by me as 'The Co-operation Tiger Census'. It was first applied by me in Orissa in 1966. The methodology has been outlined in my publication 'Let Us Count Our Tigers', appearing in volume 12, No. 2 of the CHEETAL.

Of all the evidences that a tiger leaves in the field for later interpretation, its pugmarks are the most frequent, and numerous. It is one of the very confident parameters, not only for the general recognition of the species, but tells us a great deal about the particular individual tiger. The pad of the tiger's paw is not like a solid hoof. It is soft, and feels under pressure like an inflated foot-ball bladder or a wheel tube. With the weight of the tiger's body on it there is a periferal spread of the pad on the ground. This spread, under average conditions of the soil and the tiger's gait, is of definite size and shape, which to a very large extent is individualistic. In adults, the shape and size of the pugmark also indicate the sex. True tracings of tiger pugmarks taken from comparable soil conditions can on comparison, pinpoint and sex each individual with a high degree of accuracy. This is the main principle applied in the field technique of collection of true tracings of tiger pugmarks. The details of the field technique and the results of its application in the field appear in my publications 'The Tiger-Tracer' and 'With The Tiger-Tracer' in volume 13, Nos. 1 & 2 of the CHEETAL.

The Co-operation Tiger Census requires many participants to look for the tiger and its signs and symptoms in the field. The tiger-tracer confirms the recognition of an individual

tiger and clears up any confusion where more than one tiger occur in the same counting unit. It is best applied during the winter when tigers keep more to the open ground, and roads and foot paths provide many more readily identifiable pugmarks in the field than in the summer. Nevertheless, the first attempts to census tigers on a country-wide basis were made during the last summer (1972), to train the personnel conducting the census, and prepare them for the more efficient and authentic census during the coming winter.

Personnel and Jurisdiction Infra-Structure

1. Co-operator or participant—should invariably be the beat forest guard. The smallest unit of census is a Forest Guard beat or sub-beat (in the case of large beats, the area should not exceed more than 20 sq. kms. in forests under consumptive use and 15 sq. kms. in other areas).
2. Co-ordinator—the Section Forester to harmonise the field work of not more than 5 participants.
3. Organiser—the Range Forest Officer, for overall control of the census work in his Range.
4. Chief Organiser—the Divisional Forest Officer helped by an Assistant Conservator of Forests (Deputy Chief Organiser) for all the Ranges with tiger habitats in his Division.
5. Chief Co-ordinator—an officer selected by the State Govt., and trained in the Co-operation Tiger Census methodology—vested with full charge over the census operations in the state.
6. Zonal co-ordinators. The states having tiger habitats have been grouped into the following zones, each under a Zonal Co-ordinator.
 - (i) Northern Zones: Uttar Pradesh and Bihar.
 - (ii) Eastern Zones: Bengal, Assam, Arunachal, Maghalaya, Mizoram, Manipur and Tripura.
 - (iii) Central Zone: Madhya Pradesh and Orissa.
 - (iv) Western Zone: Maharashtra, Rajasthan, Goa and Gujarat.
 - (v) Southern Zone: Tamil Nadu, Andhra Pradesh, Kerala and Mysore.

The schedule of the census operation (Summer 1972)

1. Phase 1: Training and pre-census preparations.
 - 1.1. Training of the Chief Co-ordinators—March 1 to 11 and April 5 to 11. Training imparted by S.R. Chodhury (the author) and attended also by a representative of the I.U.C.N/W.W.F.

- 1.2. The prescribed form to be used for counting was translated into the local languages by the Chief Co-ordinators and sufficient numbers of sets printed to supply them in triplicate to each participant.

A set of counting forms in triplicate, was given a serial number corresponding to its Counting Unit as allotted in the Census Register for the State. The Census Register had been carefully prepared by the Chief Co-ordinator after dividing each Range into suitable number of Counting Units. This work was completed well in advance before the actual census period in this schedule.

- 1.3. Collection of equipments—Tiger-tracer, 2 metres tape, haversack, water bottle, Plaster of Paris, polythene bags and field note books—for each participant was completed in good time before the census work.
- 1.4. Training of Chief Organisers, Deputy Chief Organisers and Organisers was imparted by the concerned Chief Co-ordinator.
- 1.5. The Co-ordinators and the Participants were trained by the Organisers.

2. Phase II. The census

2.1. Period of census.

2.1.1. Eastern Zone, April 22 to 28, because of expected early rains.

2.1.2. Rest of India, May 15 to 21.

- 2.2. Regime One—1st day through 5th day—work time according to convenience, dove-tailed into the normal duties of the staff at least once a day in the morning as per the log-book in the counting sheet. Field work consists of the following:—

2.2.1. Field reconnaissance.

2.2.2. Collection of evidences.

A. Reliable local information.

B. Signs and symptoms in the field.

AA. Actual sighting.

BB. Kill—evidence.

CC. Fecal matter (sample to be collected with date and place of collection).

DD. Clawing marks.

EE. Vocalisation heard (roars, calls etc.)

FF. Pugmarks.

GG. Tiger den (evidence of use from shed peltage, pugmarks etc., place and date of investigation, type and size of den, terrain, general physiognomy of the neighbourhood and distance from the nearest watering place).

2.2.3. Tiger-tracer evidence: the tracing with the following details (with at least two representative left rear pugmarks).

- A. Serial number of Counting Sheet.
- B. Place (name the part of the Counting Unit (Central/North/West/South/East)).
- C. Date.
- D. Time.
- E. Nature of soil (coarse sand/fine sand/fine dust).
- F. Wet or dry ground.
- G. Normal stride (at least 5 measurements).
- H. Signature of Participant.

2.3. Regime Two—for the 6th and 7th days.

2.3.1. Longest possible traverse in the Counting Unit between dawn and 9.30 A.M.—a must for every Participant—to cover those routes where there is high probability of getting the pugmarks as evinced during Regime One (2.2).

2.3.2. Tiger-tracer evidence as in 2.2.3.

2.3.3. Data of 2.3.1. and 2.3.2. to be recorded separately for each day.

Note:—Comparison of the data from Regimes One and Two will focus attention on individual tigers. It will also reveal the level of probability in getting, in different range conditions, the pugmarks of most of the tigers covered by the census, in a short time of one to two days.

3. Phase III. Collection, screening and compilation of data.

3.1. Screening at each Organiser and Co-ordinator's levels—3 days.

3.2. Collection and despatch of data (counting sheets) by the Chief Organisers, with their remarks—one week.

3.3. Verification, final screening and compilation by the Chief Co-ordinators and preparation of the abstracts in the prescribed forms—4 weeks.

3.4. Despatch of the abstract by the Chief Co-ordinators along with their reports to N.S. Adkoli, Asst. Inspector General of Forests for Wild Life, Ministry of Agriculture, New Delhi.

- 3.5. Copies of the state maps showing the habitat zones and serial number of the Counting Units will be sent in quadruplicate by all Chief Co-ordinators to N.S. Adkoli by July 31.
- 3.6. Copies of abstracts and maps in 3.4. and 3.5. will also be sent to the Zonal Co-ordinators.
- 3.7. The final compilation and confirmation of the census results will be done by M.K. Ranjitsingh, Dy. Secretary, Ministry of Agriculture, and N.S. Adkoli in consultation with the author.

Note:— Co-ordination and screening at all stages will be done with reference to the spatiotemporal field evidences during the census work and the maps showing the terrain and the disposition of the related Counting Units.

The Counting Sheet

The specimen of the counting sheet appears at page 47 (face) and 43 (reverse) of Volume 12, No. 2 of the CHEETAL and is reproduced on pages 75 & 76 of this issue.

The face of the counting sheet provides for the following:—

1. Serial number of the Counting Sheet.
2. Names of Beat, Section, Range and Division.
3. Names of Participant and Co-ordinator.
4. Overall location of the area covered by the census in the unit.
5. Broad natures of terrain, cover, factors and influences.
6. Reliable historical facts about tigers in the counting unit.
7. Reliable information about any periferal tiger outside the counting unit.
8. Remarks of the Co-ordinator and other supervising personnel.

The reverse page contains the form of the daily log of field census, morning, afternoon and evening (after dusk). The form provides specifically for,

- (i) actual sighting of tiger, sexed or unsexed adult and cubs,
- (ii) pugmarks, sexed or unsexed adult and cubs, and
- (iii) notes on other tiger-evidences found in the field.

It will be seen from the above that the counting sheets besides the census details, collect useful information about the habitat and the environmental conditions of the tiger in the Counting Units, to provide a reasonable overall view on the future of the tiger in different parts of the states censused.

PROFORMA FOR THE ABSTRACT OF TIGER CENSUS FOR EACH STATE

Serial Number	Name of Forest Division and District	Name of Range	Area statement in hectares		Total of columns No. 4 & 5	Tiger-tracer data for the 6th day, Regime II			
			Under Forest Deptt. in the range	Other forest areas in the range		dult male	Adult female	Sex unknown	Cubs
1	2	3	4	5	6	7	8	9	10

Tiger-tracer data for the 7th day Regime II for any new tiger pugmarks other than those recorded on the 6th day				Rangewise census data for Regime I (1st to 5th day) being the record of tigers which came to notice in the course of Regime I but which definitely escaped the Tiger-tracer count during Regime II			
Adult male	Adult female	Sex unknown	Cubs	Adult male	Adult female	Sex unknown	Cubs
11	12	13	14	15	16	17	18

Total tigers in the range	Total tigers in the Division	Number of tigers shot on licence in the Range 1960-70	Number of tigers killed illicitly or found dead in the Range 1960-70	Remarks
19	20	21	22	23

LET US COUNT OUR TIGERS

COUNTING SHEET NO.....

Species—TIGER (*Panthera tigris*)

Period of Count—

..... Division	Name of participant.....
..... Range	Address.....
..... Section	
..... Beat	Co-ordinator.....

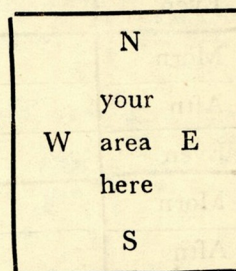
Overall location of
the area covered
during the week.

Terrain : % of — hill () / hill-plain () / plain ()
 % of — ravinous () / broken () / unbroken ()
 Cover : % of — dense trees () / open trees () / open bush () /
 open grass () / barren land ()
 Concern : a) — Natural preys — abundant/normal/bare subsistence/none left
 b) — Human competition — heavy/rational/negligible
 c) — Cattle competition — heavy/normal/negligible
 d) — Nature of protection — good/fair/bad/worse
 e) — Local co-operation — good/fair/nil

Special information from participant

Do you reliably know of any tiger in the following
layout around your counting unit ?

Counting sheet No. ?

Counting sheet
No. ?Counting sheet
No. ?

Counting sheet No. ?

Give details for the above layout as below:

- How far is the tiger from your area ?
N) E) S) W)
- What sex ?
N) E) S) W)
- Has the tiger ever come to your area of count ?
If so when, and how often ?
N) E)
S) W)
- Longest distance covered by you during the
week of count, in your area, from the centre.
N) E) S) W)
- Any other useful information.

Remarks of the co-ordinator and other
supervising personnel.

Date—May 19, 1972.

Time—1500 hrs.

Place—Nekedakacha bridge on Bhanjabasa Road, Similipal.

Soil—Fine dry road dust.

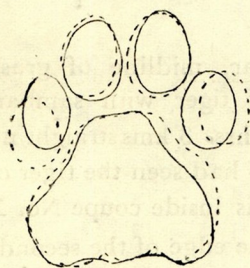
Stride—Not all front and back paws superimposed. Average stride from consecutive superimposed pugmarks—71 cm.

Front paw ----

Back paw ———

From separate pugmarks.

Left side.



An adult male tiger.

Date—May 19, 1972.

Time—1800 hrs.

Place—Between 19 and 20 km— on Bhanjabasa—Banjikusum Road, Similipal.

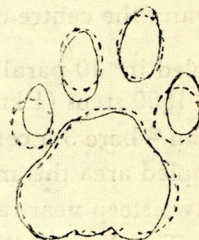
Soil—Fine dry road dust.

Stride—38 pugmarks seen. All completely superimposed. 9 strides exactly 53.5 cm. Two front paws only at the place she descended on the road.

Front paw ----

Back paw ———

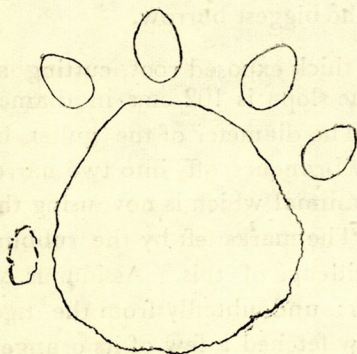
Tiger-traced from separate marks and superimposed for comparison. Left side.



An adult female tiger.

SIZE OF THESE FIGURES $\frac{1}{4}$ OF ACTUALS

DETAILS IN THE EXCERPTS FROM THE
AUTHOR'S LOG-BOOK.



An adult female tiger.

Date—May 20, 1972.

Time—0600 hrs.

Place—Deulahuhi, Satkosia F.S. XIX/2, Karanjia Divn., Orissa.

Soil—Loose patch on hand hill slope where the tigress opened out her toes to break skid — Right front. Side hairs found in her den up the hill.

Tiger Census in India

By

S.R. GHOUDHARY

EXCERPTS FROM THE AUTHOR'S LOG BOOK OF THE CENSUS WEEK IN THE SIMILIPAL HILLS IN ORISSA

PART II

May 15, 1972. 0600 hrs to 1000 hrs. Bachhurichara open valley—23 kms straight south from Nawana the centre of Similipal.

Sampled in 10 parallel strips—road towards Mohubhandar, midline of grassland to the edge—1500 steps (1 km) each. Found the recent excreta of tiger with sambar (*Cervus unicolor*) hair—bore 3.5 centrimetre diameter at 1030 hrs to 1300 hrs. 3 kms straight north-east of the sampled area this morning. The local tribal labourer who had seen the tiger cave took us across two steep near-ravinous well-wooded areas. The cave is inside coupe No. XIX, lot No. 8 of Tinadina Felling Series now under working. At the edge of the second nala he located the three burrows—one sizeably deep—which the tiger is said to be making intermittent use of. This coupe labourer had met the tiger a week back—hardly five metres from him at the head of the largest burrow. He felt, it was a male because of the bushy wide head and face, and the size.

These 3 burrows are of different sizes, made earlier by porcupines. No fresh evidence of porcupines was found, except a few old quills near the biggest burrow.

At the entrance of the biggest burrow there was a thick exposed root, cutting across the mouth at a height of 32 cm. The mouth, flush with the slope is 102 cms in diameter. The gullet is 35 cms from the exposed root at the mouth. The diameter of the gullet is 85 cms. belly is over 2.5 metres long, and beyond it the burrow branches off into two narrow lateral holes evidently used formerly by the porcupines. The animal which is now using this burrow steps in and out over the barrier of the exposed root. The marks left by the rubbing of the ventral surface of its body on the exposed root bears evidence of this. Assiduous search by Nihar resulted in us finding a number of soft white hairs, undoubtedly from the tiger's chest and belly. Similar search at the shallow second burrow fetched a few of its orange coloured side hairs. The tiger must be lying on its side in this shallow burrow.

Even if no pugmarks are seen in this area during the census week, the presence of a tiger—male—is confirmed.

1700 hrs to 1900 hrs. (Same day) Dhudruchampa—Burabalang area—Meradi hill—8 kms straight south-southeast of Nawana.

A big lime-stone cave, supposed to be a tiger's—5 years back a tiger had been seen entering it. Fresh signs of many porcupines in the cave. Porcupines are high in the palatable level for the tiger. Evidently, at present no tiger uses this cave. The local Forester (co-ordinator) had seen the pugmarks of a tigress and her cub two months back near the village Burabalang about 4 kms straight from this cave. The mother and her cub were also seen by the forest labourers in the neighbourhood of West-Dhuruduchampa. Further confirmation should be attempted during this census week.

May 16. 0600 hrs to 0930 hrs. Badmakabadi area 5 kms NE of Dhuruduchampa and 8 kms straight SE of Nawana.

Got strong smell of tiger, halfway on the road from Dhuruduchampa to Badmakabadi. However, no pugmark was found in the search. A little further ahead some tribal labourers coming from the opposite direction informed us of signs of predation upon a barking deer which they had found on the road. The signs, they said, were not there the previous evening. On the inner side of the surface of this hill-road we found, at the place pointed out by the labourers, a short and shallow—45 cm—depression on the road, lined on both sides with a few tufts of soil and a thin spray of barking deer hairs. The barking deer had apparently been grabbed with open claws, taken into the jaws and lifted clean off the ground. This explains the clawed-out tufts of soil and the spray of hairs, and, the small depression by the hoof which ceased when the quarry was lifted off the road and carried away. The hard surface of the ground held no other readily discernable sign. This could only be done by a tiger—a panther would have killed and dragged. It must be a big tiger to do this with the barking deer, the way a panther would with a hare or a monkey. A fortnight back a male tiger was reported to have been seen in this area by the coupe labourers.

The integrated evidence—the reliable local information, the smell and the method of predation (kill-evidence)—confirm the presence of the tiger in this territory although no pugmarks were seen during the census week.

May 17, 1972. 0600 hrs to 1000 hrs. Could not make it to the head of the Joranda falls, 6 kms NNE of Nawana, where there was a report of a tigress den, currently in use by her. The Coupe Mohurir (supervisor) who had seen her on a few occasions, had gone home. None else among the labourers present, knew the location.

May 18, 1972. 0530 hrs to 1100 hrs. Kachudahan area, 16 kms straight east of Nawana.

Saw the plaster-cast of the pugmark of a tigress taken by the Participant (Forest Guard of Kachudahan) from the only pugmark found by him on the right bank of Palpala, opposite

the Forest Rest House. The plaster-cast is convincing. Also saw the pugmark from which he took it.

One of the kharia women saw a tiger cross the Palpala some 15 days back; should be this tigress.

1300 hrs to 1700 hrs. Chahala area, 14 kms straight NW of Nawana.

1½ kms NE of Chahala Forest Rest House the Participant (F.G. Goura Mahanto) and his helper B.C. Sama Dehury showed me the pugmark which they had preserved. It is an impression on the soil earlier loosened by a porcupine. The pad of a tiger is faintly seen. The toe pads were not clear. About 1 km north of Chahala the F.G. showed me the second tiger pugmark preserved by him on the berm of the Chahala—Talabandh road. This is a clear one, of a female, the same which we had earlier seen this afternoon inside the forest.

There is the report of a big male tige, to the south of Chahala in the Brundaban block. More stress should be paid to the confirmation of this information during this census week.

On the way to Kadalikacha we saw two kharias looking for hill-mynas. One of them told me that his wife had seen the pugmarks—saucer size—of a tiger in the forest near the village Nuagaon-Narua about 15 days earlier. The location is 10 kms NW of Chahala.

May 19, 1972. 0530 hrs to 1000 hrs and 1430 hrs. to 1930 hrs. Bhanjabasa area 30 kms straight south of Nawana.

At 1500 hrs Nihar saw from the moving jeep, a line of pugmarks of a male tiger on her side of the road. The pugmarks were at the farthest edge, on the soft line dust lifted from the wheels of a truck, a clear line which was still fresh, moving down slope towards the Nekedakcha bridge at the 11 km-stone. The average stride between the complete or partially superimposed pugmarks was 71 cms.

At 1800 hrs Nihar again detected a line of pugmarks on her side of the road between the 19 and 20 km-stones. The tigress had come down the hill-side and jumped on to the inner edge of the road where she had left the marks of both her front feet. She then crossed over to the outer edge of the road and climbed up the U-bend to its head, after which she criss-crossed the road, leaving a few of her pugmarks on the central belt of the road which is not usually affected by the traffic. In all there were 38 pugmarks in the line, all superimposed, rear paw exactly over the front. Of the 15 strides measured, 9 were exactly 53.5 cms.

May 20, 1972. 0430 hrs to 0930 hrs. Satkosia F.S. Coupe No. XIX, lot No. 2—corridor to the Similipal hills—50 kms straight SW of Nawana.

The two supposed pugmarks preserved by the Forest Guard were, one of a front-pressed human foot and the other a hyena (right back foot) partially overlapping a cattle hoof mark.



The missing chest bones (sternum portion or ribs) indicate it was a panther kill.



Tiger walking fast.
Back paw in front of front paw.



←—Tree near Pradeep's enclosure clawed by Kananan (tiger) when she was free.



Hairs searched out from the steel trap pit indicate the poaching of the big cat.



Tiger pugmarks.



Tiger pugmarks seen through and traced on the 'Tiger Tracer.'

The Forest Guard is a new entrant, the soil fluffy and the tracks old; hence the confusion. The former forest guard of the area, Biranchi Narayan Behera who is experienced and was with us, made no mistake.

This was at the toe of the Deulahudi hill to the east. Opposite Deulahudi is a parallel ridge on the other side of which there was a report of a case of cattle-lifting two months ago. Both the Forest Guards told me about tiger caves in all these hills. We checked Deulahudi thoroughly. While doing so, Biranchi called me from his contour-belt to show me a mark which, to him, looked like a distorted tiger pugmark. It was that of a tigress coming down from a cave up the hill. She must have walked down fairly fast, over the hard bouldery surface. At this particular spot where there was a small patch of loose soil on an incline, her front right foot slipped, and to break the skid she spread out her toes to their widest—the Tiger-tracer copy shows the resultant shape of the mark left at the spot. The mark of the dew claw is clear; it was her right front foot.

Up the hill, we investigated her cave. It was Nihar again who picked up the scattered bits of orange coloured peltage dropped when the tigress had been lying on her side.

The measurements of this rocky den were 190 cms long, 146 cms $\times$ 155 cms at the entrance and 91 cms $\times$ 150 cms half-way in.

The coupe agents confirmed having heard the tigress from this and the opposite hill.

Analysis of the log-book:

1. Number of days spent in survey and tracking—6
2. Total number of hours of survey and tracking—31—42
3. Total distance travelled by jeep inside the forests—428 kms.
4. Total length of tracking on foot in the forests—33 kilometres.
5. Tiger evidences. All different tigers, male and female.
 - 5.1. Found in the field during the survey and tracking on foot.
 - 5.1.1. From the jeep, on road side—two lines of pugmarks in Bhanjabasa area, one tiger, and the other a tigress 8 kms away—on May 19.
 - 5.1.2. Found during tracking on foot—three different areas.
 - A. Excreta and tiger den with tiger hairs; one male tiger; confirmed by local people. Bachhurichara area on May 15.
 - B. Kill—evidence, method of predation; one male tiger. Confirmed by local people. Badmakabadi area, May 16.
 - C. Tigress cave with her hair and her pugmarks. One tigress confirmed by local people. Deulahudi, May 20.

- 5.1.3. Found earlier by the Participants.
 - A. One tigress from one pugmark plaster-cast. Kachudahan area, May 18.
 - B. One tigress from two pugmarks preserved. Chahala area, May 18.
- 5.2. Tigers or their pugmarks seen recently, before the census, but not located during the census. Dates indicate the collection of relevant information by the author.
 - 5.2.1. Tigress with one cub in Burabalang-Dhuruduchampa area—May 15.
 - 5.2.2. Head of Joranda falls—one tigress—May 17.
 - 5.2.3. Tiger in Chahala South—May 18.
 - 5.2.4. Tiger in Nuagaon-Nalua—May 18.
6. Total number of tigers—male and female—existing and located, and type of evidence as basis.
 - 6.1. Line of many pugmarks of the same animal—one tiger and one tigress—total, 2.
 - 6.2. One or two pugmarks plus other supporting evidence—all tigresses, 3.
 - 6.3. No pugmarks seen but other convincing evidence confirm—tigers, 2.
 - 6.4. Grand Total—7.
7. Total number of tigers—male, female and cub—reliably reported to be existing but not confirmed.
 - 7.1. Tigers—2.
 - 7.2. Tigresses—2.
 - 7.3. Cub—1.
 - 7.4. Total—5.

Use of the data:

1. Seven tigers—3 males and 4 females—are confirmed beyond doubt and will be included in the census figures.
2. Five tigers—2 males, 2 females and one cub—reliably reported but not confirmed in the field. These will be searched for, with increased vigour and additional co-operators during the remaining period of census. Further evidence will be obtained and weighed for screening, before final acceptance and inclusion in the census figures.
In this first summer census, however, none of the doubtful estimates will be included if no further tiger evidence as listed in the schedule of census, is found in the field, unless the concerned Organiser is absolutely certain from further truthful confirmation of specific local informations in each case, which he will record in convincing details for the final screening by the Chief Co-ordinator.
3. The Counting Units of the Cooperation—Tiger—Census are now permanently located and defined in the field in all the tiger habitats in the country. These units have been serially numbered in each state and registered with the Chief Co-ordinator. These will

now form the smallest permanent management units for tigers, similar to the compartments in our forestry management. Let us call them Tiger-Units, giving them the same serial number as the corresponding Counting Unit. The Tiger-Unit histories will now be maintained just as we do with the Compartment histories. I propose we do it this way.

3.1. The Tiger-Unit histories will be kept in separate guard files for each unit with the Organisers only. All basic data—location, area, terrain, cover, concern and past history—as collected during this census will be entered on one page in the same proforma as on the face page of the counting sheet. Results of the census will also be recorded with brief details of evidences. The Tiger-tracer copy will be kept below this page.

3.2. All Beat—Guards and Foresters will be supplied with pocket size Tiger—note books having alternate pages perforated at the top so that these pages could easily be torn out.

Any information about tiger in any Tiger—Unit will be recorded in this note book in duplicate (carbon) stating the serial number of the Tiger—Unit, date and place (Central/North/West/South/East).

A separate page will be used for each unit. At the time of submitting their monthly diaries, the Foresters and Forest Guards will detach the perforated carbon copies of their Tiger-note book and send them to the Range Officers with their diaries. The Organisers will put these copies in the respective Tiger-Unit histories.

3.3. The Organisers will send brief abstracts of the Tiger-Unit histories quarterly to their Chief Organisers, marking at the same time a copy to the Chief Co-ordinator.

3.4. These will provide the basic background for successive future census and a continuous pooling of data for objective management of the tiger.

REMINISCENCES

February 17, 1969. 5 P.M.—I was leisurely walking towards the carnivora enclosure to look up Kanan, “..... the only wild tigress in the world who had successfully broken into a zoo,” as Bart Mc Dowell put it in the National Geographic of October 1970.

“Ah! we were looking for you.” It was my friend Gani (S.M. Gani) coming from the opposite direction. “Meet Mr. Mc Dowell of the Senior Editorial staff of the

National Geographic. He has been keen to see you ever since he landed at the Bhubaneswar air port. In Delhi he read your article on Tiger Census in the 1968 December issue of the Orissa Review".

I took Mr. Bart Mc Dowell round the zoo. In half an hour we were back at the Forest Rest House, with Mc Dowell keen to know all about the 1966 tiger census in Orissa—and I equally as keen to tell him all about it. With a few bites from the famous Nandankanan 'pakodas' and 'laddos' and a cup of tea served by Nihar, Mr. Mc Dowell preferred to miss his dinner scheduled 17 miles away at 7.30 P.M. We talked of many things, all rambling back ultimately to the tiger and its future.

Late in the night when Bart finally stood up to go he told me "There appears to be no other practical method of counting tigers. Your Co-operation Census method has done a more important thing. It has focused the attention of the cooperator, the keeper of the tiger in our forest, to his valuable charge. He will try to look for the tiger in his area which perhaps he did not do earlier. You have stimulated his interest. He will naturally keep an eye on his tigers. And that is a great thing for the future of the tiger".

May 18, 1972. Deep inside the Similipal Hills, Nihar and I were tracking along the course of the Palpala, meandering through the dense folds of Kachudaban Felling Series.

"See there? Looks like some animals". Nihar pointed towards some movements ahead in the thicket. We slowly approached and on drawing nearer, saw clearly, two men. When we met them, the Forest Guard gave a smart salute, his helper standing behind, his Tiger-tracer in a sling on his left shoulder.

"I went to see you at Dhuruduchampa sir "he said," You had left. Back in the mid-fifties I was one of your forest guards in Baripada".

"What are you doing here? I asked.

He pointed to the Tiger-tracer "Deputed from the plains and now searching for the pugmarks. This is the local man helping me".

I remembered Mc Dowell's words. If this is the enthusiasm elsewhere in the tiger lands of my country, the Co-operation—Tiger—Census has amply served its objective.

The First Mile Stone

NIHARIKA

By

NIHAR

Four years have passed since Niharika left me. Gone for ever. We put her in a very big and comfortable grave for her peaceful and everlasting sleep.

She comes back often in my memory. I cannot forget her—her different moods—her love and affection—and her last pathetic drag to her death.

To me she was a very close friend. She loved me more than a human being. She was very sober, natured with gentle understanding. She always showed her gratefulness to us for our strenuous efforts in trying to cure that awful wound in her leg.

I met her first on March 27, 1968. I was on leave from my service and had come over to spend a few days for a change, at Nandan Kanan, the Biological Park in Orissa. S.R. Choudhury was the Wildlife Conservation Officer of the state with jurisdiction over Nandan Kanan. He was also camping there. On the 26th afternoon some people came to Nandan Kanan and informed the Range Officer, Taleb Ali, that a cow elephant wounded with gun shot and in helpless condition had been sighted in the Barapitha forest, near their village. Ali, with his colleague B. Jens and two Forest Guards, rushed out in a jeep to locate her; Choudhury was not in Nandan Kanan that day. After reaching the spot they found nothing except the foot prints of an elephant. It was dusk when they returned.

Early next morning while Choudhury was relaxing in a chair on front of the lawn of 'MAITRI KUTIR' (Tourist Lodge), his eyes wandering over the beauties of the lake and visualizing perhaps, the future development of Nandan Kanan, Ali, the Range Officer, came and told him about the wounded elephant. On hearing what Ali had to say, Choudhury hurried me to get ready to accompany him to the forest. In no time we finished our breakfast, and were in the jeep. I was in my field dress carrying with me a packet of biscuits, some water and a dozen or so bananas, in case we should not be back for lunch. Choudhury took his camera and Amar, the forest guard-cum-animal keeper took the stirrup-pump, cotton, disinfectants etc., the usual routine in such emergencies.

Prior to January 1968, I had only seen tame elephants in the Zoo and the temple elephants at Puri, but no wild elephants.

On January 27, 1968, I went to Similipal National Park along with the well-known naturalist M. Krishnan and Choudhury. There I saw a herd of five elephants crossing the road. We were in a jeep. We left the jeep and went into the forest on foot. I was wearing a sari and chappals. Both Choudhury and Krishnan tracked a tusker to photograph him. It

was late when he was located; not in a mood to pose for Krishnan to take any photographs. So we returned disappointed. The next day we tracked the tusker again and while coming back, saw from the jeep, a cow elephant with a calf; no chance of a tusker. The third day we tracked a herd. At about 3 P.M. we heard trumpeting from quite a long distance away. It was not possible to get there, nor to take photographs in the thick sal forest. That was the end of my first contact with wild elephants. I had no idea of elephant behaviour. The evenings in camp after changing out of field dress, we would sit near the fireplace and chat, and, Krishnan would tell us his many adventures with elephants in South India and the narrow escapes he had had.

On January 31, 1968 we reached Bhubaneswar. After seeing Krishnan off, Choudhury received instructions to accompany some American tourists with H. Lal, the then Secretary, Ministry of Iron & Steel, Govt. of India and S.P. Shahi, the Chief Conservator of Forests, Bihar. I had no shikar experience but was keen to accompany them. Roy Harkness, one of the tourists, had a permit to shoot an elephant. Every evening we went by jeep, with spot-light, for a panther which Dick Baum was allowed on his permit. Day time was spent either tracking or in beats.

On February 7, we tracked 20 kilometres—26,860 steps which I counted—to and back from village Kennedy to enquire about elephants. At village Kennedy we drew a blank.

After getting fresh news about elephants on 9th February, we went to village Randang. There, at mid-day, we were told that the elephants were up on the hill 3 kms away in the forest near the crop field. We climbed laboriously up that hill to near the edge of the forest where we saw the elephant damage in the 'arhar' (a pulse) crop and sat down there for a brief rest. Two of the local men went into the forest, located the elephant in the eastern valley and soon returned to inform us. We followed them to the spot. Roy Harkness with the .375 magnum on his shoulder and a heavy pistol strapped to his wide waist, was himself walking like an elephant. I saw two tuskers foraging down in the valley. I was watching both Choudhury and Roy discussing the strategy of approach, the vital shot and the back-up gun. We approached the big tusker in the valley, down wind. The other tusker had moved away in the mean time. It was hardly 60 metres from us. Then we started slowly approaching the elephant. This tusker was moving towards us! We could hear him breathing, hardly 20 metres from us!! We stopped near a pipal tree from where could not see him. One of the villagers went up the tree, saw the elephant in the nala nearby and beckoned to Choudhury to come up. Soon after, Roy Harkness too, for all his bulk and weight, climbed up the tree after handing over his rifle and the heavy pistol to me. Then I lifted Roy's rifle up to him. Choudhury's rifle was leaning against the tree. He whispered that the elephant was hardly 40 feet away. Hearing this the other villager immediately clambered up another tree. Finding me alone under the tree Choudhury virtually jumped down, picked up his rifle and waited for Roy to shoot. After a little while Roy too came

down. He could not see the vital part of the head. The tusker moved away as he must have sensed us. We returned to the village.

The elephant would again come to the field at night. On the request of the villagers we climbed up the hill a second time and sat behind big boulders near the crop field. There was a pale moon in the sky. Roy had a white shirt on. Our shooting camp had been wound up. Others had moved on to Rayagada in the afternoon. After shooting the tusker we were due to join them there. The tusker came to the edge of the field. The older one of the two villagers crawled through the 'arhar' crop and saw the still form at the edge of the forest. We waited and waited and waited—time dragged on—naturally some of us got restless. I was ready with Roy's powerful flash light, waiting for the elephant to come out but the elephants did not. And that was again a blank draw.

Late in the evening we plodded back to the jeep at the village. Roy was in high spirit; no regrets; that was sport. He paid the villagers and added a fat packet of American chocolates to the cash. The villagers were very happy, urging him to come again. On our way to Rayagada we saw a beautiful big sambar stag hardly 5 metres from Roy in the jeep. He just looked at that prize trophy. His rifle lay on his lap. Unlike many others he would not shoot. That again was a real sporting gesture true to the laws and ethics of hunting.

While travelling in the jeep to see the wounded cow elephant I was recollecting these past memories sitting in my usual place, the front right side, where I have the advantage of looking for the tracks of animals.

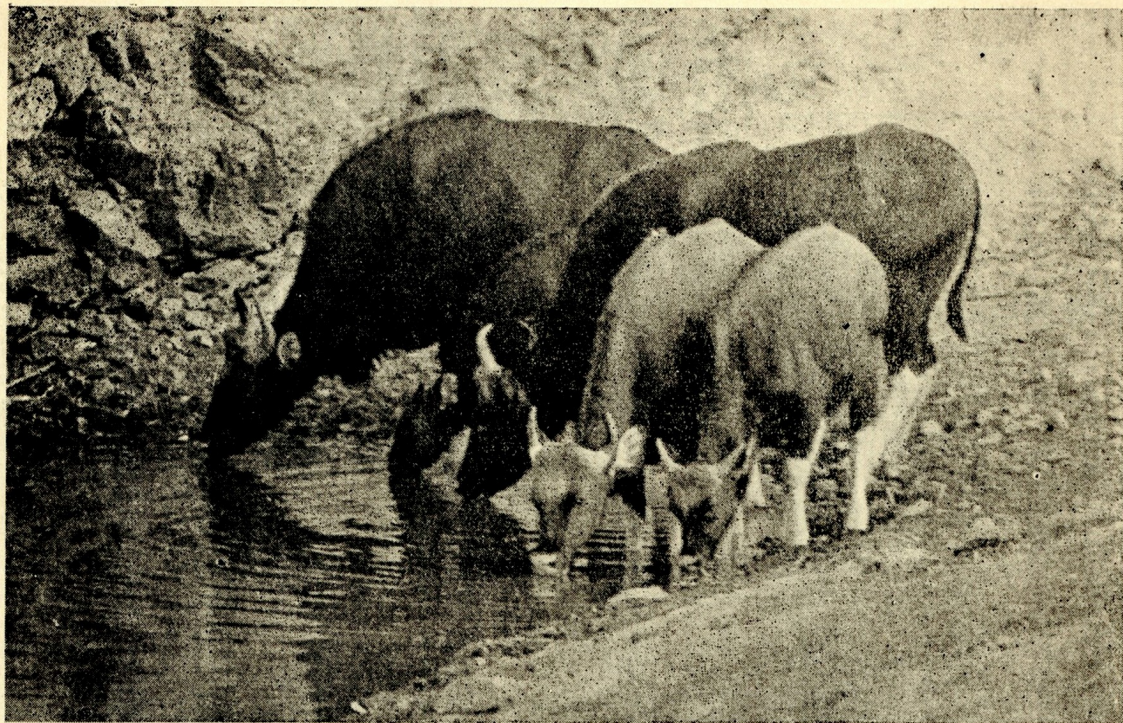
We reached the spot as instructed by Ali and saw nothing. On enquiring from passers-by we came to know that the elephant was on the eastern side of the forest. Some villagers were there watching her from a distance. We could see some one teasing her, throwing stones at her. We also noticed an immense swelling on her right hind leg near the knee joint and her skeleton-like shape. She was not able to move properly. With her wounded leg pulled up slightly, she limped about chasing the people. Alas ! what a pitiful sight ! Poor girl; how much pain she was bearing; why can't these people leave her alone ? Choudhury went ahead, stood behind a tree and took photographs. Amar and Jena went to the side where the villagers were. I watched a little distance away under a tree. Kulamani, one of the villagers with a blue lungi was the worst teaser and I marked that whenever he came near the elephant she would rush towards him, jumping on three legs, breaking branches and throwing dust on her body and sometimes throwing big stones towards him. Choudhury scolded him for teasing her, and for a while she got some rest. I marked that she would take out from her mouth with her trunk, some thick slimy substance and throw it on her body; perhaps she was exhausted and thirsty and wanted some water, I thought. But water was nearly $\frac{1}{2}$ kilometre away in the Deras Dam. It was the month of March. The sun was very hot. After sometime I gave a few bananas to Amar to try and give her some. First he threw a small bunch to her and she just trampled it deliberately under her foot,

showing her disgust. Again I told him to give the second bunch to her at the end of a long bamboo. This she took and threw it back over her shoulder with apparent disdain. I was now left with the last bunch of only four bananas. I saw, she was standing still and smelling us by repeatedly pointing the tip of her trunk towards us. There was now silence all round. I tried to coax her with soft talk, using all the endearing words in my language, Oriya. Then I noticed that she stood silent and gave me a long look. Half an hour passed like that. Every time I spoke to her, 'Aa-re-ne' (come and take my dear) she would look at me. I put the bananas at one end of a small stick and holding the other end offered those to her—speaking the same words, 'Aa-re-ne-aa' in a soft low voice and slowly, very slowly, I approached her. When I was very close to her she hesitated a wee moment, lifted her trunk, took the bananas from the stick, leisurely put them into her mouth, and threw the ends, with a swing of her trunk, across her right flank. Every one including me was astonished. I thought she would charge me. She was hardly 2 metres from me. Choudhury came and congratulated me. It was already 2 P.M. and we were feeling hungry. One packet of biscuits, hardly 24 pieces, and we were 15 people to share it. I gave one to each villager, and Choudhury and I took two each, drank water and sat down for few minutes to discuss what we would do next. Choudhury told Amar to keep the stirrup pump ready to spray water on her.

After a little while she was given a good bath with the stirrup pump by spraying water all over her body. By 3.30 P.M. we left the place after requesting the villagers to keep watch without disturbing her.

After a bath and tea we took rest and discussed her behaviour. Ali arrived and we discussed how best to capture her for treatment. Choudhury told him to arrange some sugarcane and plantain stems to take with us the next morning. Later all three of us went to Cuttack to get a 3" diameter manila rope to tie her with. I made an eye-splice and the rope was ready by night.

The next day on the 28th, we were ready very early in the morning. Dr. L N. Acharya, the Veterinary Assistant Surgeon at Nandan Kanan accompanied us. Ali was also there. We could not find the elephant where we had left her the previous day. She had gone down the hillock, crossed a small creek to the opposite hill slope. A lot of people were there. After we reached the spot I took two long pieces of sugarcane and from a distance held them to her. She immediately took them and started eating. I kept her engaged in eating, while Choudhury went behind her, selected a low stump and tried to slowly pass the eye of the spliced end of the rope between her hind legs to tie her by the left hind leg. I saw him take the spliced-end round her left hind leg, and, by chance his hand touched her leg somewhere. She gave such a kick with her wounded leg that Choudhury was thrown back on a big boulder near a thorny bamboo clump, his shirt torn, and his ring gone from his finger. But



A herd (though incomplete) drinks at a water hole.



A lone black bull. (*Bos gaurus*)

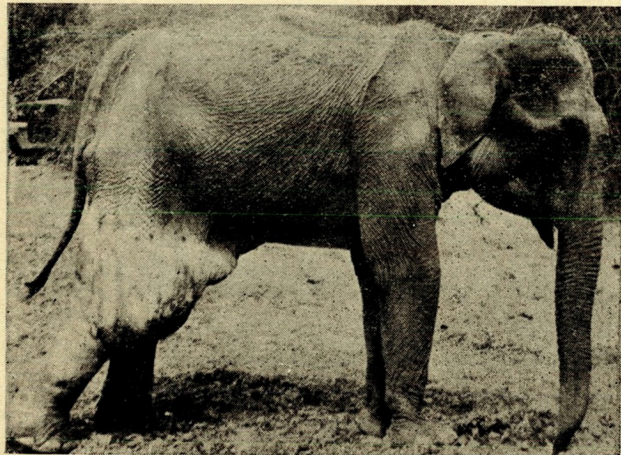
Photograph by—S.P. Sahi.



Niharika and the author on March 28, 1968.



Medicine pills being made by the author.
Khamari Eudha and Siva watching.
Niharika in the back ground.



Niharika on April 18, 1968.



Niharika and the author
on March 31, 1968.

Photographs by Shri S.R. Choudhury.

with only a few scratches on his body he quickly got back to her again and this time succeeded in putting the noose round her leg before she could give a second kick. He was now looking rather happy after tying the rope securely to the stump. When she found that she was captured she strained and pulled and wailed for a short while, but soon she settled down again with the sugarcane, plantain stalks and bananas.

People named her N!HARIKA—she was only 25 years old. At her age she could have smashed all of us if she were in proper health—but she had been made an invalid in a cruel way.

In Chandaka and Barapitha forests there were lots of elephants. They usually go into the nearby crop fields. Perhaps she had also done so, and someone shot at her with a gun. With so much pain she came limping back without any food. Perhaps from that day she had not taken enough food. Neither the gunman nor the villagers knew her agony; poor innocent creature. We saw her but did not know her dire struggle for life. I fed her some twenty plantation stalks and a dozen sugarcanes.

By 10 a.m. two other tame cow elephant of the Zoo arrived with their mahuts to give her company. With the help of these elephants she was tied by her neck to a tree for easier dressing and treatment of her wound. Choudhury and Dr. Acharya started dressing her wound.

They measured her round her right knee which had swollen to nearly two metres girth, apparently packed with pus. At the back of the knee joint towards the innerside there was a 15 cm diameter bulge, the callosity at the point where the bullet had entered. This hardened growth of the skin was choking the hole which could provide the only outlet for the accumulating pus. Choudhury and Dr. Acharya first removed the growth by cutting it flush to the skin. The hole was now wide open. They slowly coaxed a probe in, which penetrated nearly half a metre in. That was the awful wound which had set into a type of gangrene which an elephant only could bear without a whimper of complaint—Niharika had wanted to be left alone to bear it silently before she met us, or rather we met her.

The inside of the wound was cleaned as far as possible with pieces of gauze gripped at the end of a long artery-forcep. Liquid terramycin was packed in and the hole plugged. The swelling was formented and warm analgesic paste was applied all over it. 12,000,000 units of Dicrystacin was injected. Not even a whimper from that gentle animal, wondering perhaps at the paradoxical antipode in human behaviour. She continued to take the delicacies I offered her. Two streaks of tears rolled down her cheek. That was all that conveyed the harrowing pain she was bearing—poor Niharika.

We could not go back to Nandan Kanan for lunch, nor had we brought any packed lunch. All of us were feeling very hungry. The mahuts had brought rations for their elephants, rice, turmeric, jaggery (gur), salt etc., in a kerosine tin. Choudhury told them to

boil some rice for us. There were no utensils. The old mahut Iswar Khamari, cooked rice in that tin with the turbid water from the creek. The Driver and Bhanja caught some shrimps with their 'gamchha' (towel). With a little turmeric and salt Khamari budha fried it without oil for us. All of us took the rice and the shrimps—real jungle life. Back woodsman cooking.

At 4.00 p.m. the dressing, cleaning etc. started again after I had begun feeding her. A villager trapped a jungle-fowl and sold it to us for Rs. 2.00. It was barbecued over fire and salt or no salt, each of us had a piece. By 8 P.M. we returned to Nandan Kanan. Lilabati and Radharani with their mahuts stayed back with Niharika.

News about this wounded elephant flashed out all over Orissa—and people started coming to see her in large numbers

Although Niharika had got friendly with me on the very first day, I still did not have enough confidence on her. I thought that if I approached too near, she might crush me. But I was wrong. On the third day of her capture I found that she did not take the banana I offered her from a distance. Perhaps she wanted me to come closer. I did, gathering up all my courage, and it was only then that she took the bananas. When she put the bananas into her mouth I started, hesitatingly at first, patting her. She lifted the tip of her trunk towards me—my pulse raced,—but Niharika was only smelling me all over to get more intimately acquainted with me. Then I knew how wrong I was in my misjudged apprehension. Could such understanding be inherent in animals? I remembered the story of Androcles and the Lion.

Old man, Khamari told me later that a wild tusker had come the previous night, stood at the edge of the opening and kept looking at Niharika for a long time. Perhaps he was her boy friend who would intermittently come back to look after and console her. When he saw that she was in good company and well cared for, he finally decided to go and never returned.

For Niharika, Dr. Acharya had brought some vitamins and other oral medicines which I tried to give her with jaggery and rice put inside a ball of hay, but she refused to take this because of the smell of medicines. Later I could dupe her by sealing the powdered medicines in cut pieces of plantain stalks—and by making pills from the powder which I concealed inside bananas.

Choudhury and Acharya dressed her wound once in the morning and a second time in the afternoon. Before we returned in the evening she was given the intramuscular antibiotics.

For two weeks thereafter, our daily routine was early morning to Niharika, feeding her, dressing and medicating her wounds and back to Nandan Kanan in the evening. I used to

take daily two dozens bananas, and a jeep load of sugarcane and plantain stalks. When our jeep reached the opposite bank of the creek she would prick up her ears and turn her head in our direction. There, she would stand still, waiting for me to cross the creek over the narrow trestle bridge which we made with bamboos. With the bananas in my hand and hidden behind me I would try to pass her feigning to ignore her. She would stop me with her trunk, turn its tip up and hold it in front of me in the manner of a begging palm, its single lip corresponding to our upper lip, twitching in pleading for her due, the bananas. She would not leave me till I gave her the hidden bananas. She would take them with relish and a grateful look and them. When I caressed her body I could feel the tremour of her happiness. She could not speak but what she conveyed by her silent expressions was more poignant than any speech. We had reached that subtle realm of communication where speech fails, but feeling sustains in a manner that can only be felt; it cannot be narrated.

We made a shade over her with cut branches. She looked comfortable and was growing more lively. Her incessant flapping of the ears, the swinging of her tail and the rocking of her body, told us that she was getting better, responding to the treatment. We were happy and full of hope. Her daily bath was a ritual. Lilabati and Radharani would stand on either side of her while perched on their backs, Khamari budha and Shiva gave her a thorough drenching. Her fore-head would then be smeared with castor oil. Artist Gunanidhi, one of the mahuts, decorated her head and trunk with vermilion and coloured powder. No one could tell her apart from the other tame elephants. Only that she looked still so very frail.

All the ropes were taken off her. She made friends with everyone. The place became crowded with people. They came in boats, carts and jeeps and more on foot, to see her. "Poor thing" said many, "what brute had the heart to inflict such a wound on this mute animal. Such people bring the curse of God on them, and their children and, their names gets wiped out from the face of this earth". This is what the villagers said, men and women, all of them, whose crop fields remained still exposed to the depredation by wild elephants; for indeed, they were all human beings.

All went well till mid-April when suddenly Niharika's health took a turn for the worse. On the 15th morning when I greeted her she appeared dull and listless. As I looked into her eyes I could see that yawning despair. Choudhury, close on my heels, saw it too. He tried to conceal his anxiety by saying that it was the large accumulated pus pocket below the knee-cap which had to be opened and drained out, after which she would be alright. "See, with all the suction devices that we made, I have not been able to get out the pus from that pocket," he said, "We have to take her to Nandan Kanan to open it." How he would do it, he was himself not very sure yet. He wanted to coax her across the shallow creek and then in slow stages walk her to the motor road $\frac{1}{2}$ kilometre away. From there she

was to be taken to Nandan Kanan by a low tractor-trailor of the type used for the transport of rails. "Let us come and stay here", he said "We will see what can be done." "If only we had a helicopter", Choudhury was wishfully thinking aloud.

That day we pitched tents near the main dam, a kilometre from Niharika. The wound was dressed a third time at 10 P.M. Back in the tent I could not have a wink of sleep. My thoughts hovered around Niharika. I could not bear to think of her walking in her present condition. She had become so dependent on us that she must have forgotten how to limp on three legs.

In my sleep I dreamt of Niharika—A helicopter come hovering above her. Niharika was strapped into a comfortable sling. A line of cable came down from the helicopter. The sling was hooked to the cable and Niharika was gently lifted from the ground. Up she went, much above the hills. Suspended in the air she was being carried to Nandan Kanan. But all on a sudden the hook gave way. Niharika crashed to earth on a field of ripe paddy crop. She lay there limp, without a sound, without a movement.

With a start I woke up. I heard the first heralders of early dawn, the red-vented bulbul and the magpie robin; the crows would come later. I got up to prepare for the days ordeal.

(To be continued)

International Youth Conference on Human Environment

By

PRIYADARSHINI DAVIDAR

As I was staggering around the Toronto airport carrying my heavy suitcase, trying to get my bearings, a tall gentleman appeared as if from nowhere and asked me if I had come to attend the International Youth Conference on the Human Environment. I flashed him a yes-smile and gratefully transferred the ponderous suitcase to his person. He led me where he had already collected some participants at the conference counter and soon we were on our way to Hamilton.

McMaster University in Hamilton, where the International Youth Conference was to be held, was modernistic and situated on the shores of Lake Ontario, about two hours drive from the Niagara Falls.

Technology and over population have made continuity of life on earth a bit uncertain. Due to the rapid deterioration of the biosphere and the resulting anxiety among some of its inhabitants, coming a bit too late perhaps, the UN decided to discuss this problem at a conference at Stockholm, Sweden this June. Since the youth have a larger stake at issue, a conference was organised at McMaster University between the 20th 30th August 1971 on their initiative, sponsored by the IYF, IUCN Environic Foundations International in co-operation with UNESCO and the UN Human Environment Conference Secretariate. The Conference was attended by more than 270 delegates, observers and pressman from about 70 countries.

I still had not got over the shock of finding myself at an International Conference. Most people I met that night seemed to convey to me by their remarks the impression that we Indians were irresponsible and were solely responsible for over-population in the world and asked probing questions as if I was an expert on the reproductive behaviour of the adult Indian. I hope it was only an introductory subject, like the weather

Six of the seven Indians at the Conference were genuine. The seventh was a student in the USA. In fact most of the Asians were from U.S. Universities. There was a lot of conjecture as to how they could know about the environmental problems in their respective countries when they had not been there for several years. However, they were highly qualified and knowledgeable.

The conference started with a whimper and went on to a bang. Due to the fact that most of the briefings, resource people etc. were from the developed world, the Third World

(Asia, Africa and Latin America) rebelled. We pointed out that the environmental problems of the Third World were not caused by overdevelopment but rather by underdevelopment and exploitation of natural resources by the developed world. It was also the developed world that polluted a large portion of our biosphere. It was also felt by the Third World that talking in terms of curbing industrialisation was unthinkable when only technology can hope to solve the multitudinous problems of poverty, unemployment disease etc. faced by the Third World. However, the necessity of taking effective steps to minimise pollution caused during industrialisation, was emphasised.

We assembled into regions (Asia, Africa, Latin America, N. America, Europe and Australia with other Pacific Islands) to prepare the regional reports. I also had a difference of opinion with other Indian delegates over the environmental problems caused by cattle-overgrazing, soil erosion, crowding out wild life etc.

The delegates on the whole were friendly and informal. Those from the developed world were obviously greatly worried about various problems, where they were leading to, and intent on action. The developing world were more casual but on their guard. Most of the developed world delegates had more or less set ideas about India. They thought a large portion of our population was starving, many were meditating and the rest, the elite, were talking glibly at International Conferences.

The workshops began. I attended the one dealing with the environmental aspects of the management and use of Natural Resources. The problems in developing countries were somewhat similar. A disgusted member of the workshop, speaking with regard to extensive eucalyptus cultivation expected eucalyptus to be the only tree left on the earth after some years. The need for education about the environment was greatly stressed at this workshop.

There were speeches by Barry Commoner, J Goodwin, Perez Olindo and others. One sentence from Barry Commoner's speech still rings in my ears. He said 'long ago some cell must have synthesised DDT and never lived to tell the tale'. He also branded 'Technology' as the greatest destroyer of the Environment. He stressed the fact that birth-rates automatically come down when the standard of living rises in a country. Jean Goodwin speaking on 'Endangered species' enlightened us on several facts regarding the successful smuggling of animal skins in and out of countries. We were also addressed by Maurice Strong, Secretary General of the United Nations Conference on the Human Environment. I must confess that to some of us who were inexperienced in conferences and conference jargon, some of the talks and discussions went over our heads. How nice and useful it would be if a conference jargon dictionary were to be brought out!

The objectives of the conference were to increase awareness, especially among the youth of the world, to environmental problems and set the basis for an International Action Programme. The major objective was to elect a youth voice to the UN 1972 Conference on

Environment at Stockholm. Twelve delegates were elected. Two from each region. The Asian delegates were Nyugen Thanh from South Vietnam, who was also the spokesman for the delegation, and Sarjeet Singh from Malaysia.

It is hoped that some effective International Action will result from the Stockholm Conference and not just word pollution, recycled incessantly.

We in India live in a far from perfect environment. Our filthy streets and cities, dirty rivers, air, untreated industrial effluents and indiscriminate felling of forests, will convince most that there is a lack of awareness even among the educated, especially among our youth. We have an advantage over the developed countries. We have not reached the point of no return. With good planning we can still save our environment.

Subjects like environmental pollution and ecology should be included in school curricula at all levels and mediums. Camps could be organised to bring youth closer to nature. In India, we have such vast wilderness areas which could be saved with timely action. The first step would be to bring youth face to face with nature. In this we are very fortunate. We have such glorious mountains, such beautiful lakes and rivers, dense forests and lonely beaches. Let our youth go out and meet them.

The youth of today is going to inherit the earth of tomorrow. So why not we plan a less polluted world to live in and make our life more pleasant ?

Gibbons in Mahananda Wild Life Sanctuary

A pair of White-browed Gibbons (*Hylobates hoolock*) was introduced in Hatisar block in the Mahananda Wild Life Sanctuary of Kurseong Forest Division in March 1965. In March 1972 a troupe of five was noticed, in which there was a new born baby. There are two females and three male gibbons including a new born one. All the animals appears healthy. On enquiry it was revealed that local staff saw the first off-spring in 1970, and the second in 1971. These animals live in one troupe and always move together.

It is fascinating to watch these most active and interesting creatures playing, eating, jumping or simply basking in the sun. From local enquiry, it is known that they are resident in Hatisar block. They are shy and avoid human approach by moving into the interior of the forests. They are almost entirely arboreal, rarely descending on the ground, except for drinking water from the river Panchanai which flows through the western boundary of the block. They usually cry at about 8 a.m. in the morning and 3 p.m. in the afternoon. Their cries are heard from the Forest Rest House, Sukna which is about 500 metres from the area.

Habitat

1. The elevation of Hatisar block is about 200 m. above mean sea-level. The climate is tropical. The maximum temperature is in April and minimum in January. The minimum and maximum temperatures are 27°C and 19°C respectively. The rainfall is heavy. It varies from 300-400 cms. The rain starts from the end of May and lasts till the end of September. For the greater part of the year the atmospheric humidity is very high.

The soil is sandy loam and rich in humus. The river Panchanai forms the western boundary of the block, but the water of this river dries up during the summer months.

2. Hatisar block is only 175.6 ha. in area. Almost the entire area has been felled and planted up with sal (*Shorea robusta* Gaertn. f.), teak (*Tectona grandis* Linn. f.), Champ (*Michelia champaca* Linn.), chikrase (*Chukrasia tabularis* A. Jum), gamar (*Gmelina arborea* Roxb.), latore (*Artocarpus chaplasha* Roxb.) etc. A narrow strip of the original vegetation lies in the southern boundary which contains dumur (*Ficus glomerata* Roxb.), bahera (*Terminalia belerica* Roxb.), kharane (*Symplocos theifolia* Don.) etc.

3. Dumur, latore, champ, gamar, bahera bear edible fruits and are the main source of food for the animals. Dumur fruits are available from January to July, latore from March to August, champ from August to September, gamar from April to July and bahera from November to February.

Besides the fruits of the aforesaid trees, the gibbons are found eating sal flowers and young leaves of chikrase, kharane and bahera.

Due to scarcity of water during summer months, water troughs are provided in the forest block.

A Note on the Young of the Shrew, *Suncus m. murinus* (Linnaeus)

By

H. KHAJURIA

Two litters of the shrew were collected on 25.8.70 and 28.8.70 from a shelf of a deserted wall almirah and a drawer of a table respectively, in Jabalpur city and kept in wooden cages with wire-netting doors for observations. Some interesting unrecorded data were collected on their external characters and habits. The litter collected on 25.8.70 included three young ones (10, 20). The measurements are given in Table 1. Although not fully grown their behaviour was practically like that of the adult. They were very active. They took a vespertilionid bat (*Scotophilus h. heathi* Temminck) and grasshoppers. They frequently tried to snatch away the prey from one another. They showed cannibalistic habits: when one of them died, the other fed on it. They first attacked the throat of the prey and then chewed through the lower jaw. They appeared to prefer flesh to insects. They were not found to take bread and water kept in the cage. They were kept under observations for about a week.

The litter taken on 28.8.70 was hardly 24 hours old and included four young. The measurements are given in Table 1. They were blind and covered with shining short, light brown fur, much thinner and lighter in colour (whitish) on the ventral aspects. The shanks were very sparsely haired. The teeth were not fully erupted. The sound given out by them resembled *chi-chi*, *chik-chik*, *chin-chin*, *krin-krin*. They were fed on diluted buffalo milk but all died after 48 hours. They were fed upon by the older youngs referred to above. From table 1, it may be seen that the ear and the tail are proportionately longer in the adults while the foot is shorter.

Table 1

Measurements in mm. of adults, sub-adults and newly born young of *Suncus m. murinus*

Specimens studied	Head & body	Tail	Hind foot	Ear	Weight (gm.)
Adults (3 specimen)	114-124 (117.6)	77-83 (79.7), 66.7% of H.B.	19-20.5 (19.8), 16.8% of H.B.	13-14 (13.3), 11.3% of H.B.	
Subadults (1 specimen)	92	57-62, 4% of H.B.	19, 20.6% of H.B.		
Newly born young (4 specimen)	67-83.5 (79.5)	33-41 (38), 47% of H.B.	16-17 (16.2), 20.3% of H.B.	7-8 (7.5), 9.4% of H.B.	9.9-11.5 (10.7)

∠1—Figures in parenthesis indicate mean values.

∠2—Figures followed by the expression '% of H.B.' indicate the measurements as percentage of head and body length.

FORM IV

(See Rule 8)

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I, S. Oswald, hereby declare, that the particulars given above are true to the best of my knowledge and belief.

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Wild Life Tourism in India

By

DR. A.G. RADDI

In India, by the term wild life we really mean wild nature, in all its fascinating diversity. Development of tourism related to this aspect of India's heritage is indeed a very interesting and challenging assignment. It involves amongst other things, drawing on the potential of wild nature on its own, as well as in combination with India's traditional and well known historical and cultural assets to attract tourists. Judging by any standard, it is conceded that India has enormous potential for development in this field. Consider for example the great diversity of flora and fauna, that India has. The Himalayas in the north are distinctively temperate. The coniferous forests, alpine meadows, the gigantic snow covered peaks and slopes of the Himalayan ranges, and mountain streams bubbling with clear water, present admirable opportunities for anyone interested in skiing, trekking, mountain climbing, trout fishing etc. The well known Himalayan hill resorts in Kashmir, Himachal Pradesh and Uttar Pradesh, already attract a large number of visitors, and as more and more facilities are provided their numbers will increase. The Gulmarg area in Kashmir is already being developed into an international standard ski resort. Efforts are also underway to set up in the Himalayas a proper national park or wild life sanctuary, for effective protection and display of high altitude forms like the brown bear, black bear, snow leopard, musk deer, hangul and the variety of mountain sheep, goats and related forms that occur in the area e.g. (bharal, goral, serow, markhor, ibex, urial, nayan, tahr etc.)

The faunal features of the Ladakh area in the north are related to those of Tibet, and forms like wild yak, Tibetan antelopes etc. are reported to be found in this region, particularly in the vicinity of some of the ancient Buddhist monasteries of the area. Eventually, when these areas are opened out in a planned manner, they would undoubtedly constitute an interesting touristic experience.

The rest of India, on the other hand is distinctly tropical; and harbours interesting wild life forms like the tiger, lion, leopard (including black melanistic forms) rhinoceros, elephants, gaur, wild buffaloes, etc. The antelope types include nilgai, fourhorned antelope, chinkara, and the black buck; whereas the deer family and related forms include sambar, cheetal, hog deer, swamp deer, the brow—antlered deer, barking deer, mouse deer, etc. The sloth bear, hyaena, wolf, jackal, fox, wild dogs, wild pigs, also occur along with them. Of course, within this tropical region, the habitat varies from scrubby types to heavy rainfall forests and this in turn also affects, the distribution of animals and birds. The wild ass

or onager is, for example, confined only to the arid desert environs of the Runn of Kutch in Gujarat.

The bird life of India is also equally varied. Large numbers of migrant waterfowl and other bird forms come to India in winter and flamingoes breed in the Runn of Kutch. Additionally the resident bird life is also diverse.

Apart from well known types like peacock, pheasants, partridges, quails, jungle-fowl, bustards, hornbills, floricans and parakeets, there are numerous other forms of great interest to the bird watcher. An ornithologist can thus spend many fascinating hours watching the varied bird life of an Indian forest.

For those interested in sport fishing—apart from the trout which occurs in the cold waters of Himalayan streams, and in some areas of the Western ghats (i.e. Nilgiri, Munnar etc.) the most interesting fish is the mahseer. This fish species is a formidable fighting fish and occurs in suitable water masses throughout the country; and has been a source of great delight and excitement to many an angler.

To the naturalist—the large turtles, crocodiles and gavials (long snouted crocodiles) found in Indian rivers are also of observational interest; so also are the monitor lizards, found in the Indian jungles. The enormous wealth of beautiful flowering plant life including the exquisite orchids from the rain forests of Eastern India and its attendant birds, insects, butterflies etc. are excellent material for special interest tours like botanising, lepidoptery etc. Planned efforts are presently underway to make this natural heritage available for the purpose of tourism.

Samples of this rich natural heritage are protected and displayed in National Parks and Wild Life sancturies created in the country. These happen to be so distributed, that a visit to them can conveniently be combined, with a visit to other cultural and historical places of tourist interest. Some of the more important ones are shown in the table.

The most common methods for wild life viewing in India are either riding on elephant back or driving through forest areas in a mini-bus or jeep. Wild life viewing from an elephant back in the jungle is an experience which is unique and which only India can provide. The elephant has a remarkable propensity for pushing through thick undergrowth, crossing swamps and streams and when necessary even tracking animals. One gets consequently a much better appreciation of the wild life. The wild life forms also allow an elephant to come near and consequently photography is interesting. Of course one has to make allowance for the breathing and other movements of the elephants—but a good Mahout and trained elephant can perform wonders. Not only will the Mahout orient the elephant in such a way as to make good photography possible—but will also make the elephant stand absolutely still for a brief spell for the cameras to click away.

National Park/Wild Life Sanctuary	*Important species commonly seen
Kanha National Park (Madhya Pradesh)	Tigers, gaur, cheetal, sambar, swamp deer, black buck.
Kaziranga Wild Life Sanctuary (Assam)	Rhino, swamp deer, hog deer, wild buffalo.
Corbett National Park (Uttar Pradesh)	Elephants, tiger.
Periyar Wild Life Sanctuary (Kerala)	Gaur, elephants, sambar.
Gir Wild Life an Sctuary (Gujarat)	Lions, peacocks, leopard.
Bharatpur Wild Life Sanctuary (Rajasthan)	Waterfowl, nilgai, cheetal, sambar.
Mudumalai Wild Life Sanctuary Tamil Nadu)	Gaur, sambar, elephants.
Bandipur Wild Life Sanctuary (Mysore)	Gaur, cheetal, elephants, sambar.
Taroba National Park (Maharashtra)	Gaur, cheetal, sambar, crocodiles, wild pigs.
Manas Wild Life Sanctuary (Assam)	Scenic beauty. 2 hour float down Manas river watching wild life on bank, wild buffalo, golden langur, gaur, rhinoceros, cheetal, elephants, etc.
Sariska Wild Life Sanctuary (Rajasthan)	Nilgai, cheetal, sambar, tiger.

*The list is only of forms commonly seen. Many other wild life forms may also be present in the area, but may not necessarily be easily seen.

Wild life viewing through a motor vehicle is a different kind of experience. One is of course confined to the forest roads—as unlike East African plains the Indian jungles restrict vehicle movement. The forest roads have, however, an atmosphere of their own and pass by grassy meadows, streams, rivers etc. and interesting wild life forms can be seen either crossing the roads, or grazing by the road-side during the early morning and evening hours. Many times vehicles equipped with spot lights take visitors for a drive in the forests at night. This also can be fascinating. Myriads of fireflies may twinkle all around, giving an appearance of a fairy land or in the roving spot light, eyes may suddenly shine up from the vegetation beyond. It is an engrossing and interesting experience to identify the animals forms just from their shining eyes. Many animals which are shy during day time and confine themselves to the heavy undergrowth, come out in the open at night—and are consequently

observable. The excitement of taking a curve on a forest road and suddenly finding a tiger fully illuminated by the car's lights is tremendous. Sometimes during the course of a night drive, the vehicle stops, all lights are put off; and one just absorbs the sounds of the Indian jungle—with a starry sky above.

For a visitor it is useful to combine a vehicle drive through the forest with an elephant ride. Watch towers have also been constructed for the purposes of wild life viewing at selected places in the national parks and wild life sanctuaries. Here, interested visitors can watch how wild nature transforms itself as evening merges into dusk—and then on into the night: The calls of various animals and birds, the sounds of their movements through the jungles before they appear; the incessant sound of insects are all a fascinating part of watching wild nature from a watch tower.

In India we are all too aware of some of the shortcomings that are felt in respect of tourist facilities available at national parks and wild life sanctuaries; and efforts to remove them are well under way.

Recognising that the existing forest bungalows, though they have an old world charm and atmosphere about them do not provide the required quantity of accommodation. The Department of Tourism has recently financed the building of wild life lodges in selected national parks and wild life sanctuaries like Kanha, Kaziranga, Bharatpur, Gir, Corbett, Bandipur, Dandeli, etc. The existing lodge at Jaldapara is also being extended.

Such a move it is hoped will provide reservation, accommodation and catering facilities of proper standard, to the tourists. Additional tourist facilities like a bar, swimming pool, proper electricity and water supply, Reception Centre, Petrol Pump, wireless and telephone communication, laundry, workshop for minor repairs to vehicles, are also hoped to be provided. The tourist complex could also include shops where basic provisions as well as local curios, handicrafts, wild life literature, etc. could be purchased. Additionally a nature centre consisting of an auditorium, museum, aquarium, arboretum etc. could be constructed. This could help to introduce to the visitors the natural history of the area. The auditorium could be used to project slides and films of wild life and natural history interest as well as those on interesting cultural and historical themes. This could be an interesting and useful way of utilising some of the spare time that the visitors may have.

The existing accommodation in these areas will also be improved in terms of basic essentials and could thus serve as a second level accommodation, in contrast to the newly constructed wild life lodges. Additional tourist accommodation in the form of organised tent camps, camping sites for tourists coming with their own tents, dormitories for student groups are also being envisaged.

To obviate to some extent the difficulties of transport for wild life viewing, special minibuses built on a jeep chassis and having four wheel traction, have been provided to selected

national parks and wild life sanctuaries. These vehicles are also equipped with spotlights, and microphone, and are quite suitable for movement along forest roads, and useful for wild life viewing during day time or at night.

Where necessary, the Department of Tourism may also provide additional elephants for use by tourists for wild life viewing. In areas having large lakes, and where wild life viewing can also be done by boats, specially built motor launches, could be provided. It is also hoped to examine the possibilities of having air strips in the vicinity of the lodges from where small planes could land and take off as such a move will not only cut down the time required to reach these forest areas, but will also enable interested tourists to visit other places of cultural and historical interest in the relative vicinity. For example a visitor from Kanha National Park could fly to Khajuraho and see the exquisite sculptures, or from Bharatpur or Sariska go to Agra and Jaipur. Additionally this, will also link these areas to air fields, to which regular Indian airlines flights operate—a move that will be particularly meaningful in the context of visitors from abroad.

With the co-operation of all concerned authorities it is hoped that our major national parks and wild life sanctuaries will also have well designed entrance gates where arrangements for checking for arms as well as receiving entrance fees will be made. On entering the gate a visitor must get a feeling that he is entering a different world.

The various categories of staff involved in managing the different national parks and wild life sanctuaries facilities would need to be provided with distinctive uniforms and trained for the job that they are expected to perform. In addition to staff required for protection of the area, we would need park naturalists to give talks and organise films and slides shows on natural history matters. They could also take interested naturalist visitors on walks in the park and explain the various interesting things going on. Fishing guides could assist tourists interested in sport fishing; photographic guides with training in natural history and photography could accompany tourist groups in a national park or wild life sanctuary and advise on and facilitate photography of wild life species.

Efforts are also underway to set up wild life parks in the vicinity of large cities and important tourist centres where one could drive through the enclosures and observe wild life forms in their relatively natural habitat. A lion park is being set up in the premises of Hyderabad Zoo, and other likely spots are presently under survey.

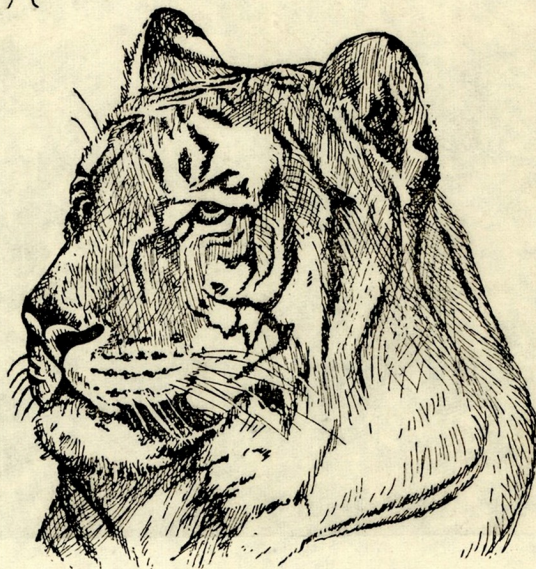
India has also been gifted with a large coast-line along which many beautiful beaches occur. Two important areas in this context i.e. Kovalam in Kerala, and Goa, are hoped to be developed into major beach resorts of international standards. Work in Kovalam is already well advanced and in addition to the modern hotel and beach cottages, etc. it will have also a yoga-cum massage centre. The latter, making use of traditional Indian methods

of maintaining body tone and health will be a new experience for many of our visitors from abroad.

Additional efforts are also being made to locate important coral areas for designation as marine sanctuaries and national parks and link them up with the beach resorts for the purposes of skin diving, goggling, snorkeling in the beautiful coral gardens. Oceanic sporting fish like marlins, sail fish are also known to occur in Indian waters and the possibilities of developing planned deep-sea sports fishing in conjunction with our beach resorts is also being looked into.

Effective publicity material on India's wild life attraction is also being planned and would be available for the potential visitors. There is no doubt that wild life tourism in India is being put on a firm footing, so that it can play its rightful role in India's tourism development effort. India's cultural and historical assets have been of proven value from the point of view of tourism. With the wild life aspect now added to it, India will be in a very strong position to provide a pleasant, memorable and unique holiday for any tourist who visits us.

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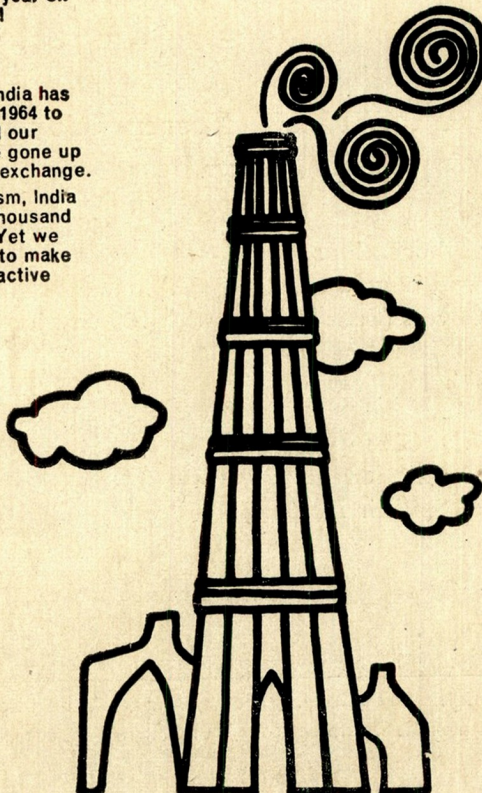
Nothing but broad-based public participation. And enough of what is known as the 'infrastructure' : hotel accommodation, transport facilities and tourist amenities. For instance, the city of Bangkok alone has more hotel beds suitable for tourists than the whole of India !

And when the Jumbo jets come, bringing many thousand more visitors our way, we shall need all these amenities in far greater measure.

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